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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | January, 1965 | Vol. 8, No. 1

1. Pheasant Populations and Land Use

S. L. Etter

It was estimated that 7,071 pheasants (2,888 cocks; 4,183 hens), or an average of 191 per section, were present on the 37-square-mile Sibley Study Area just prior to the 1964 hunting season. The estimated numbers of pheasants on the study area immediately prior to the 1962 and 1963 hunting seasons were 15,224 and 10,391, respectively.

For 1964, as for 1962 and 1963, the estimate was calculated using the following ratios:

$$(1)\quad \frac{\text{Number of Tagged Cocks Shot by Hunters Interviewed (31)}}{\text{Number of Cocks Tagged during Prehunt Period (203)}} = \frac{\text{Number of Cocks Shot by Hunters Interviewed (441)}}{\text{Number of Cocks Present during Prehunt Period (X)}}$$

where X = 2,888 cocks; and

$$(2)\quad \frac{\text{Number of Cocks Tagged during Prehunt Period (203)}}{\text{Number of Cocks Present during Prehunt Period (2,888)}} = \frac{\text{Number of Hens Tagged during Prehunt Period (294)}}{\text{Number of Hens Present during Prehunt Period (X')}}$$

where X' = 4,183 hens.

The above estimates and information obtained about age ratios, numbers of broods, numbers of nests established, and proportions of established nests that were successful in 1963 and 1964 (Monthly Wildlife Research Letters; September, October, November; 1964) indicate that the production of pheasants on the Sibley Study Area in 1964 was 30-40 percent lower than in 1963.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

The density of pheasant nests on seeded roadside plots in 1963 was 3.1 per acre in fencerows and 2.8 per acre in the remaining portions of the plots (Table 1). In 1964, 2.5 nests per acre were established in fencerows and 4.0 nests per acre in the remaining parts of these plots. Thus, the increase of almost 1 nest per acre in total nest density on the seeded plots occurred in those portions exclusive of fencerows.

In contrast to the seeded roadside plots, on managed control roadside plots (unseeded), nesting tended to be concentrated in the fencerows in both 1963 and 1964.

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On managed control plots, fencerows underwent a reduction of 2.7 nests per acre from 1963 to 1964, compared with a decrease of only 0.9 nest per acre in the remaining areas of the plots. Proportionately, however, the changes were similar.

The data indicate that in 1964 pheasants found those areas of the seeded plots outside the fencerows to be more attractive for nesting than they were the preceding year. Apparently, the seedings offered better quality nesting cover in 1964 than in 1963. The data on nest establishment from the managed control plots indicate that the preferred nesting cover on these plots was in the fencerows. This is probably a result of the higher and denser cover that generally exists in most fencerows as compared with other parts of the managed control plots.

Table 1. Densities of pheasant nests on seeded and on managed control roadside plots, Sibley Study Area.

Type of Plot	Acres		Nests		Nests per Acre	
	1963	1964	1963	1964	1963	1964
Seeded						
Fencerow	1.3	2.0	4	5	3.1	2.5
Remainder	14.1	15.9	40	63	2.8	4.0
Total Acreage	15.4	17.9	44	68	2.9	3.8
Managed Control						
Fencerow	1.0	1.7	9	10	8.7	6.0
Remainder	14.0	16.0	32	28	2.3	1.4
Total Acreage	15.0	17.7	41	38	2.7	2.2

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

In 1964, the prehunt population of pheasants on the experimental release area at Neoga, as determined by interviewing local farmers, was estimated to be 126 birds (63 cocks and 63 hens). This estimate indicated that the prehunt population at Neoga in 1964 was 37 percent less than in 1963, and 76 - 82 percent less than during the years 1960 through 1962.

The estimate of the prehunt population in 1964 also suggested that the number of hens on the area increased 163 percent from May to October. During the first 3 years of this study (1960-62), the May to October increase in the number of hens on the area ranged from 91 to 134 percent. During similar periods in 1963, the number of hens decreased. Thus, although the population was low, it appears that productivity of pheasants at Neoga was higher in 1964 than in any of the 4 preceding years.

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis, R. L. Westemeier

During prehunt censuses conducted November 1 - 12, 1964, totals of 220, 286, and 268 quail were observed on the Alma, Dale, and Forbes study areas, respectively. Population densities expressed as birds per 100 acres were 3.7 on Alma, 26.5 on Dale, and 14.2 on Forbes.

Conditions for censusing with dogs were extremely poor during November. A prolonged drought that began in August and continued until mid-November, coupled with frequent periods of high temperatures and strong winds, made it difficult to locate quail during the censuses.

Estimated prehunt populations on the Dale and Forbes areas in 1964 were smaller than in 1963. The prehunt population on Dale in 1964 was 3.7 percent smaller than in 1963 (297), and the prehunt population on Forbes in 1964 was 23.2 percent smaller than in 1963 (349).

The prehunt populations in 1964 represented increases of 120 percent on Alma, 522 percent on Dale, and 129 percent on Forbes when compared with the prebreeding (March) populations. The dramatic increase in numbers of quail from spring to fall on the Dale Area possibly reflected the principle of inversity and the quantity and quality of available nesting and brood-rearing cover on the area.

R values (Monthly Wildlife Research Letter, May, 1964) were calculated from locations of quail coveys found during the prehunt census in 1964. The R value for the Dale Area was 1.28, indicating a significant departure from random toward uniformity. The R value for the Forbes Area, 1.12, did not depart significantly from random. In 1963, R values for the Dale and Forbes areas were 0.95 and 1.36, respectively. The improvement in the spatial relationships among coveys on the Dale Area in the fall of 1964, as indicated by the increased R value, is attributed to more favorable habitat conditions than existed in the fall of 1963. If the assumption concerning R values is valid, then the distribution of coveys on the Forbes Area in the fall of 1964 reflected a deterioration of habitat conditions when compared with that of the preceding year.

5. Responses of Prairie Chickens to Habitat Manipulation

R. J. Ellis

In order to understand better the relationship between the acreage of nesting cover and prairie chicken numbers, cover on the areas chosen for annual counts of cocks on booming grounds was mapped during April and early May, 1964 (Monthly Wildlife Research Letter, July, 1964). Idle fields of grass and grass meadows were the only cover types found which were not disturbed during the nesting season.

To test the apparent relationship between the number of booming cocks per 1,000 acres, counted on the census areas in 1964 (Monthly Wildlife Research Letter, April, 1964), and the percent of area in grassland undisturbed during the nesting season, the data were subjected to regression and correlation analysis (Figure 1). The resulting correlation coefficient, $r_{(8)} = 0.688$, exceeded the reference value at

the 5 percent level of probability, thus supporting the concept that the number of cocks on booming grounds is dependent on the amount of undisturbed grassland in the vicinity. As the number of cocks on booming grounds is a good indicator of population size, the significance of the test applies to the population as well as to the cocks.

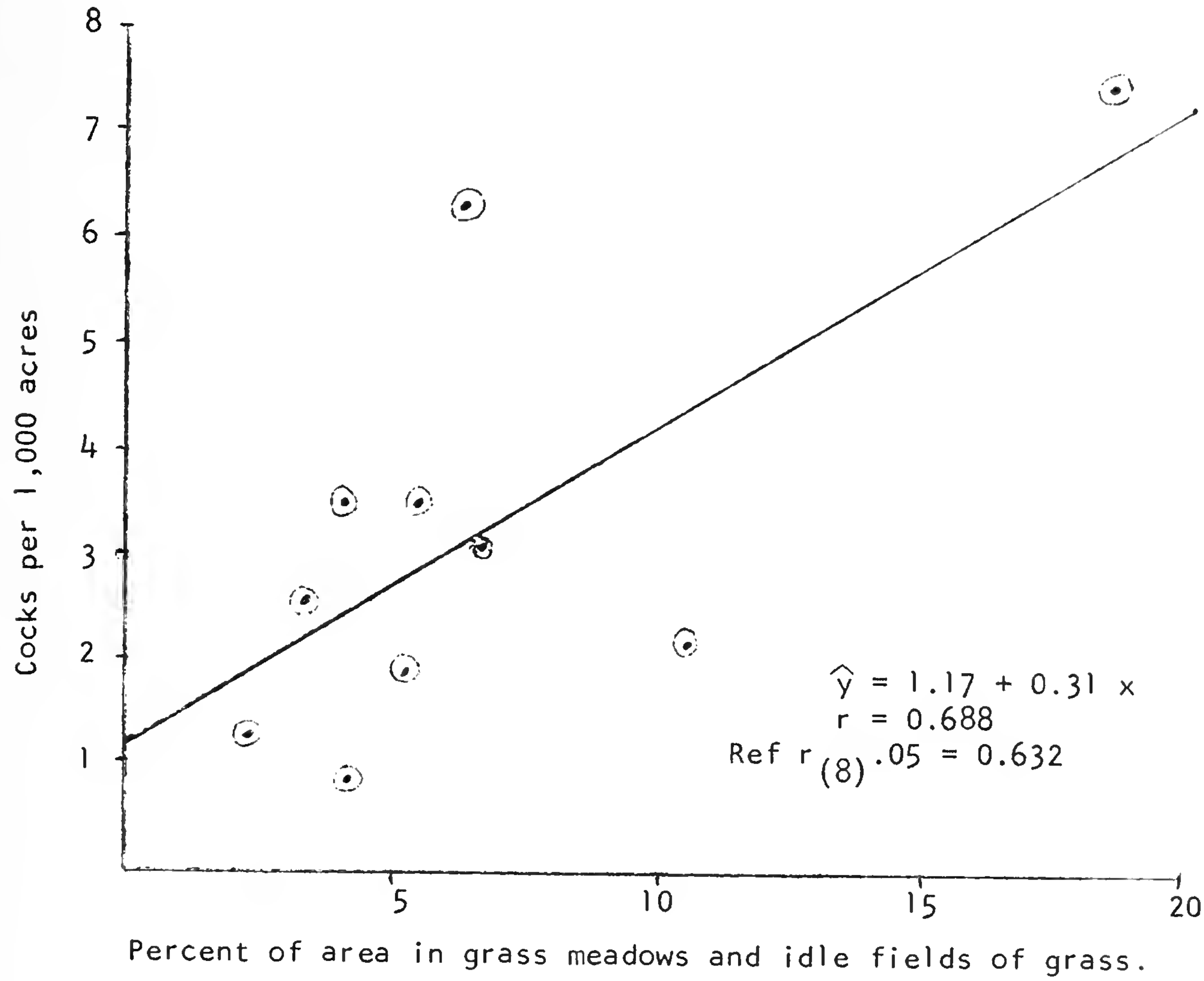

Figure 1. Relationship between number of male prairie chickens counted on booming grounds in 1964 and percent of area in grass meadows and idle fields of grass on 10 census areas during the summer of 1963.

6. Rabbit Management

J. A. Bailey

Data obtained from the annual fall census and from capture records of cottontail rabbits on the Allerton Park 4-H Area have indicated that considerable natural mortality occurs in this rabbit population during the 7 weeks immediately preceding the hunting season. The fall census indicated a mortality of 23 percent from October 5 to November 5 (Monthly Wildlife Research Letter, November, 1964). A second method for calculating mortality (Lord 1959) likewise indicated a mortality of 23 percent during this period.

Capture records from monthly 10-day trapping periods in October, November, December, and January provide a third method for calculating mortality. Only the 65 cottontails handled during the early-October trapping period were used in these calculations. Of these, 18 were never caught again and 47 were recaptured during November, December or January. The indicated disappearance rate from October to November was 18 ÷ 65, or 28 percent. Some of the 18 rabbits which were never caught after October should have been alive in November even though they were not caught during that month. Therefore, the indicated disappearance rate should have exceeded the actual mortality rate.

Ten of the 65 rabbits caught in October were not caught in November but were caught in either December or January. The disappearance rate from November to December was 30 percent. Therefore, we can estimate that 14 (10 ÷ 0.70) of the October-caught rabbits were alive but not captured during November. We can use this figure to adjust the October to November disappearance rate and obtain an estimate of October to November mortality. Four (14 - 10) of the 18 animals which disappeared after October are estimated to have been alive in November. The estimate of early-October to early-November mortality is therefore 14 ÷ 65, or 22 percent. This supports the previous estimates of 23 percent mortality.

It is concluded that this rabbit population declined by about 22 percent from October 5 to November 5 - and the opening day of the hunting season was still 19 days away! (Preliminary estimates indicate that the total mortality from October 5 to opening day was around 36 percent.)

Recapture records indicate that mortality was greatest among the youngest rabbits. Table 2 indicates, by size-classes, the disappearance rates for rabbits caught in October. The disappearance rate for rabbits weighing less than 900 grams in early October was especially high. The disappearance rates for known-adults* and for rabbits weighing more than 1,300 grams in early October probably over-estimated the mortality in these groups since our data indicate that these rabbits have a low probability of capture.

Lord, R. D., Jr. 1959. A method for measuring mortality of cottontail rabbits in winter. J. Wildl. Mgmt. 23(2):241-243.

Table 2. Recapture records and disappearance rates for cottontail rabbits caught in October 1964 on the Allerton Park 4-H Area.

Weight in Early October (grams)	Number Caught, October	Number Recaught, November or Later	Disappearance Rate (percent)	Number Recaught, December or Later	Disappearance Rate (percent)
Under 500	3	1	67	0	100
500 - 900	8	4	50	4	50
900 - 1,100	9	7	22	6	33
1,100 - 1,300	21	19	10	10	52
Over 1,300	9	6	33	6	33
Known-Adults*	15	10	33	6	60

* Known-adults are animals which were captured and released on the 4-H Area during, or prior to, the spring of 1964.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois February, 1965 Vol. 8, No. 2

1. Pheasant Populations and Land Use S. L. Etter

At least 55 percent of the pheasants present on the Sibley Study Area during early fall, 1964, were not present by late February, 1965. About 19 percent of the population loss could be directly attributed to hunting; it was estimated that 9.5 percent of the hens and 33.5 percent of the cocks (age-classes combined) were shot during the 1964 hunting season (Table 1). In view of the apparently high level of nonhunting losses occurring among pheasants of both sexes, possibilities for substituting hunter-mortality for some of the natural mortality should be considered.

The above estimates of population losses are conservative, because the basic assumption was made that the only mortality suffered by adult hens (the age-class used to estimate losses for all other age-classes) was a result of hunting. A more realistic estimate of adult hen mortality would probably range between 25 and 35 percent for the October-February period each year; estimates of losses for the other age-classes would be proportionately higher.

Changes in the composition of the Sibley pheasant population were estimated from the sex and age ratios of 507 pheasants trapped during October and November 1964, the age ratios of 150 pheasants trapped during January and February 1965, and the sex ratio of 4,532 pheasants observed on the area during January and February 1965.

Table 1. Relative mortality rates of pheasant sex- and age-classes, Sibley Study Area, October 1964 - February 1965.

Age-Class	Number per 100 Adult Hens in the Prehunt Population		Percentage Loss		
	Prehunt	Posthunt*	Hunting	Unknown Causes	Total
Adult Hens	100	90.5	9.5	?	9.5
Juvenile Hens	151	57	9.5	52.7	62.2
Adult Cocks	23	7	38.5 †	31.1	69.6
Juvenile Cocks	149	29	32.8 †	47.7	80.5
All Birds	423	183.5	19.3	37.2	56.5

* Corrected for a 9.5 percent illegal kill of hens; the average estimated rate of illegal hen kill for 1959-62 was based on fluoroscopic examination of winter trapping samples.

† Based on number of tags recovered from cocks tagged during October and November (1964) and known to have been shot in November and December (1964).

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2. Manipulation of Pheasant Habitat

G. B. Joselyn

An expansion of the data dealing with locations of pheasant nests along roadsides (Monthly Wildlife Research Letter, January, 1965) provides a comparison of pheasant nest densities on seeded and on managed control plots with and without fencerows in 1963 and 1964 (Table 2). In 1963, plots with fences made up 63.2 percent of the total seeded plot acreage and contained 65.9 percent of the nests. In 1964, 75.2 percent of the total seeded plot acreage was made up of plots with fences, but these plots contained only 58.8 percent of the nests. There were 3.0 nests per acre on the area with fences in 1963, and 2.6 nests per acre on the area without fences. Nest densities in 1964 were 3.0 and 6.4 nests per acre, respectively.

In 1963, 49.4 percent of the total managed control plot acreage was made up of plots with fences, and 61.0 percent of the nests occurred there (3.4 nests per acre). In 1964, 68.1 percent of the nests occurred on plots with fences (2.1 nests per acre); these plots made up 61.0 percent of the total managed control plot acreage. Nest densities on the area without fences were 2.1 nests per acre in 1963 and 2.4 nests per acre in 1964.

Chi-square criteria were utilized to determine whether significant differences in nest establishment existed in either 1963 or 1964 between plots with and plots without fences. The 1964 data for seeded plots show that establishment of nests on the portion of the seeded plot area without fences was significantly higher than expected, and that nest densities on the portion with fences was significantly lower than expected ($X^2_{.05} = 8.92$). Seeded plots with fences had a greater average width (18.1 feet) than those without fences (16.3 feet). Fencing, width of plots, and type and density of cover will all bear close scrutiny in the future, since they may furnish vital information regarding optimum roadside conditions for pheasant nesting.

Table 2. Pheasant nesting in relation to fences on seeded and on managed control roadside plots, Sibley Study Area.

Type of Plot	Acres		Nests		Nests per Acre		Percent of Area		Percent of Nests	
	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964
Seeded										
With Fences	9.7	13.4	29	40	3.0	3.0	63.2	75.2	65.9	58.8
Without Fences	5.7	4.4	15	28	2.6	6.4	36.8	24.8	34.1	41.2
Total Acreage	15.4	17.8	44	68	2.9	3.8	100.0	100.0	100.0	100.0
Managed Control										
With Fences	7.4	12.6	25	26	3.4	2.1	49.4	61.0	61.0	68.1
Without Fences	7.6	5.0	16	12	2.1	2.4	50.6	39.0	39.0	31.9
Total Acreage	15.0	17.6	41	38	2.7	2.2	100.0	100.0	100.0	100.0

3. <u>Factors Influencing Distribution and Abundance of Pheasants</u> W. L. Anderson

It was estimated that 239 pheasants were present on the experimental release area at Bellmont during the prehunt period (October) in 1964. This estimate was based on the principle of the Lincoln Index, whereby pheasants were captured by nightlighting during the prehunt period, marked with backtags, and released in the fields in which they had been captured. Subsequently, local farmers and sportsmen were asked to keep records of the numbers of marked and unmarked birds they saw while hunting pheasants on the area. These records provided three known values, from which a fourth value (prehunt population) was calculated by using a simple ratio formula.

The sex ratio among all pheasants found and age ratios among cocks and among hens captured by nightlighting indicated that the 239 birds included 138 cocks (122 juveniles and 16 adults) and 101 hens (73 juveniles and 28 adults). The preponderance of cocks in the population was suggestive of differential rates of death between the sexes during the summer and early fall of 1964. The estimate of 28 adult hens in the prehunt population suggested that less than 5 percent of 646 hen pheasants released on the area in March 1964 survived to the following October.

4. <u>Responses of Bobwhites to Habitat Manipulation</u>

J. A. Ellis, R. L. Westemeier

The 1964 quail harvest, the recovery of marked quail in the kill, and the January 1965 posthunt censuses provided population estimates for the Dale and Forbes areas (Table 3). The prehunt population estimates based on one or on two of these three sets of data were believed to be more realistic than the estimates derived from the November 1964 prehunt censuses (Monthly Wildlife Research Letter, January, 1965). A prehunt population estimate of 620±133 quail was obtained for the Forbes Area, based on the recovery of tagged quail during the hunting season. The recorded kill plus the results of the posthunt census produced an estimate of 400 quail in the prehunt population on Forbes. If these were maximum and minimum estimates, it seems reasonable to conclude that the 1964 prehunt population on Forbes was approximately 500 birds. Thus, densities of the prehunt population on the Forbes Area, expressed as quail per 100 acres, were similar in 1963 and 1964 (Table 3).

On the Dale Area, prehunt population densities were similar in 1964 and 1963, according to the estimates based on the recorded harvests plus the results from the posthunt censuses (Table 3). The proportion of marked birds in the kill during the 1963 and 1964 hunting seasons produced unrealistic estimates of the prehunt populations on the Dale Area, and are not given in Table 3.

From the harvest data for Forbes in 1964, it was possible to estimate the number of adult males on the area during the breeding season. Data obtained by using the number of marked and unmarked adult cocks in the harvest and the number of adult cocks marked from mid-May to mid-July produced an estimate of 139±17 cocks on the Forbes Area during the breeding season. Only 117 quail (both sexes) were found on Forbes during the prebreeding census in March 1964. The difference between the

results of the prebreeding census and the estimate based on the recovery of marked birds in the harvest was probably due to the high mobility of bobwhites in summer. The prebreeding census in March, completed within a few days, was conducted during a period of the year when mobility of bobwhites is minimal. The 2-month trapping period, however, occurred at a time of year when mobility of bobwhite cocks is probably at a peak. Movement data show that cock quail traveled distances as great as 3.2 miles during the summer of 1964, which suggests that the size of the breeding population on Forbes may be greatly influenced by immigration of quail from adjacent habitat onto the area. Also, intensive and extended use of the cock-and-hen trapping technique on an area, as on Forbes, could conceivably inflate the population of adult cocks by attracting cocks from adjacent habitat to hens used as bait in the traps.

Table 3. Estimates of prehunt (November) quail populations on two census areas.

AREA Estimate Basis	Number of Quail 1963	1964	Percent Change from Prebreeding Census 1964	Quail per 100 Acres 1963	1964
FORBES					
Prehunt Census	349	268	+129	23.2	14.2
Harvest + Posthunt Census	372	400	+242	24.7	21.2
Tag Recoveries	360±134	620±133	+430	23.9	32.9
DALE					
Prehunt Census	297	286	+522	40.1	26.5
Harvest + Posthunt Census	263	346	+652	35.5	32.0

5. <u>Responses of Prairie Chickens to Habitat Manipulation</u> R. J. Ellis

It is certain that if prairie chickens are to be preserved in Illinois, nesting refuges must be provided very soon (Monthly Wildlife Research Letter, December, 1964). Because refuges are often expensive to acquire and maintain, it is important to know how large a refuge system must be to insure survival of one flock.

Any prairie chicken preservation program in Illinois probably should aim to maintain no fewer than 500 prairie chickens in the fall population on each refuge system. Smaller populations probably would decline to precariously low numbers in years of extreme weather conditions.

It is estimated that approximately 500 acres of good nesting cover are required in southern Illinois to maintain a prairie chicken flock numbering 500 in the fall. This estimate is based on the average of data collected at Bogota in 1963 and 1964 (Ellis 1964, Ellis 1965). It assumes a hatching success of 73 percent of the nests, 10.2 hatched eggs per successful nest, a 40 percent survival of young, and a fall age ratio of 3 juveniles per 2 adults. It also assumes a rate of nest establishment

of one nest per 5 acres of refuge. Although this is a higher rate of nest establishment than the average achieved at Bogota, it is realistic to assume that such a nest density can be achieved, because densities as high as one nest per 2.4 acres have been found at Bogota (Ellis 1965:7).

Ellis, Ralph J. 1964. Responses of bobwhites and prairie chickens to habitat manipulation (B. Prairie chickens). Pittman-Robertson Job Completion Rept. W-66-R-3, Job 13. 11 + [15] pp.

Ellis, Ralph J. 1965. Responses of bobwhites and prairie chickens to habitat manipulation (B. Prairie chickens). Pittman-Robertson Job Completion Rept. W-66-R-4, Job 5. 12 + [14] pp.

6. Rabbit Management

J. A. Bailey

Allen (1939) and Haugen (1942) reported weight losses occurring in cottontail rabbits during the winter. Haugen noted that weight losses occurred during severe weather, when the animals moved very little.

On the Allerton Park 4-H Area, few rabbits lost weight during the time intervals between monthly trapping periods (fall-winter, 1964) prior to January (1965). However, most of the animals lost weight between the January and February trapping periods (Table 4). The February trapping followed a week of very cold weather with snow on the ground. Our data, and those of Haugen (1942), suggest that it is normal for cottontails to restrict their movements and feeding during severe winter weather while they draw upon body reserves to meet energy requirements. Obviously, the animals' ability to do this is limited. The following observations indicate the limits of this adaptation.

Weight losses sustained by cottontails between the January and February trapping periods on the 4-H Area were as large as 12 percent of the January body weight. This suggests that rabbits can lose 12 percent of their weights and survive at least long enough to be trapped.

In an experiment reported by Kline (1964), rabbits were starved in outdoor cages during February. These animals succumbed after 6 to 14 days, when they had lost about 20 - 25 percent of their original weights.

Cottontails captured several times during any 10-day trapping period on the 4-H Area have almost always lost weight with each successive capture. Confinement in the trap prevented the animals from feeding during their normal periods of activity. These animals lost up to 21 percent of their original body weights. Many of these rabbits were caught again during later months; some were never caught again. The proportion of the animals that were never caught again is called the disappearance rate. Although disappearance rates tend to overestimate mortality, they can be used as indicators of mortality when comparisons are made. Table 5 indicates that rabbits which lost more than 15 percent of their body weights because of excessive trapping had an unusually high disappearance rate. A statistical test of these data (adjusted interaction chi-square = 2.17 at 1 degree of freedom)

indicates significance at an 82 percent level of confidence. I believe that a larger sample would have afforded a higher level of confidence.

Our data and those of Kline (1964) indicate that during severe winter weather cottontail rabbits can lose up to 15 percent of their body weights without adverse effect. In contrast, weight losses of more than 15 percent frequently result in mortality.

Allen, Durward L. 1939. Michigan cottontails in winter. J. Wildl. Mgmt. 3(4): 307-322.

Haugen, Arnold O. 1942. Life history studies of the cottontail rabbit in southwestern Michigan. Am. Midl. Nat. 28(1):204-244.

Kline, Paul D. 1964. Starvation and weights of cottontails. Paper presented at the 26th Annual Midwest Wildlife Conference, December 7-9, Bloomington, Indiana.

Table 4. Month-to-month changes in the weights of cottontail rabbits on the Allerton Park 4-H Area, 1964-65.

Interval between Trapping Periods	Number of Rabbits That Lost Weight	Number of Rabbits with Same Weight	Number of Rabbits That Gained Weight
September to October	1	0	23
October to November	2	2	22
November to December	2	1	26
December to January	2	2	18
January to February	13	3	0

Table 5. Weight losses and disappearance rates of cottontail rabbits caught four or more times during any 10-day trapping period on the Allerton Park 4-H Area, September 1964 - February 1965.

Weight Loss during Period: Percent of Original Weight	Number of Rabbits Recaught in Later Trapping Periods	Number of Rabbits Never Caught Again	Disappearance Rate (percent)
0 - 15	16	5	24
16 - 22	2	4	67

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois March, 1965 Vol 8, No. 3

1. Pheasant Populations and Land Use

S. L. Etter

An aerial census of the prebreeding population of pheasants on the Sibley Study Area on March 5, 1965, resulted in a count of 1,684 pheasants, an average of 47 per square mile. These data represent a 58.3 percent decrease from the 4,043 pheasants (112 per square mile) observed during an aerial census of the area on February 27-28, 1963. The absence of sufficient snow cover prevented a census in the spring of 1964.

The low prebreeding population in 1965 appears to be largely the result of the low rate of production in 1964 (Monthly Wildlife Research Letters, September and October, 1964). On the basis of a comparison of the aerial census data and the fall population estimates for both years (Monthly Wildlife Research Letters, January, 1963 and 1965), it appears that the winter mortality rates were essentially the same in 1963 and 1965.

A significant portion of the winter mortality in 1965 may have occurred during the snowstorm of February 24-25, after which 19 dead pheasants (4 cocks and 15 hens) were found by project personnel. All these deaths appeared to be directly or indirectly attributable to the high winds and blowing snow. In view of the small number of carcasses usually found, it seems likely that many pheasants died during this storm.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

In 1963, estimated dates of nest establishment were obtained from 21 of the 44 pheasant nests established on seeded roadside plots (Table 1). Peaks of nest establishment occurred during the weeks of May 6-19 and June 3-16; approximately 24 percent (10 nests) of the 21 nests were started each of these periods. By June 3, slightly over 57 percent (12 of 21 nests) of all nests of known dates of establishment on seeded plots had been initiated.

Accurate data on establishment of nests were obtained from 17 of the 68 nests found on the seeded plots in 1964. As in 1963, peaks of nest establishment on seeded plots appeared to occur during the weeks of May 6-19 and June 3-16, but nest establishment in 1964 apparently had a slightly greater spread over the entire summer than in 1963, with a greater percentage of nests established at later dates. Thus, a lower percentage of the established nests had been started by June 3 in 1964 (47 percent, 8 of 17 nests) than by the same date the year before. Also, a higher percentage of nests were initiated after July 1 in 1964 (nearly 18 percent, 3 of 17 nests) than were initiated after July 1, 1963.

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Sample sizes for both years are small and it is problematical whether the data are sufficient for meaningful interpretation. However, the dates of nest establishment on seeded roadsides are of more than academic interest. If management plans involving seeded roadsides over large areas are to be of practical value, managers will need data on the progression of nesting on these roadsides. Especially important is the mowing of seeded roadsides: from the standpoint of public relations, mowing should begin in the summer as soon as it will have the minimum effect on nesting. In 1963, all nests on seeded plots were either abandoned, destroyed, or hatched by July 25, but in 1964, 4 of the 14 nests that hatched did so after August 1. In 1963, mowing beginning on July 25 would have destroyed no nests but, in 1964, would have destroyed nearly 30 percent of the nests which eventually hatched.

Table 1. Seasonal distribution of the establishment of pheasant nests on seeded roadside plots, Sibley Study Area.

Period of Establishment	Number of Nests Established	
	1963	1964
April 15 - May 5	3	1
May 6 - 19	5	4
May 20 - June 2	4	3
June 3 - 16	5	4
June 17 - 30	3	2
July 1 - 14	0	3
July 15 - 28	1	0
Total	21	17

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

Tests of the ability of various species, subspecies, and strains of pheasants of the genus *Phasianus*, and hybrid progeny thereof, to produce self-maintaining populations south of the established pheasant range in Illinois have been conducted on the Neoga Area for 5 years, 1960 through 1964, and on the Bellmont Area for 2 years, 1963 and 1964. In all 5 years at Neoga, available evidence indicated that factors suppressing the pheasant population on the area were concerned more with survival than with reproduction.

It now appears that the pheasant population at Bellmont is exhibiting trends similar to those detected among pheasants on the Neoga Area. A total of 1,155 pheasants were released at Bellmont during the winters of 1962-63 and 1963-64, and 936 chicks (estimated) were produced during the subsequent nesting seasons. However, it was estimated that only 239 pheasants were present on the area during the prehunt (October) period in 1964. These findings suggest that the Bellmont population also is suffering from excessive mortality.

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis, R. L. Westemeier

The increase in the number of quail harvested on the Forbes and Dale study areas in 1964 as compared with 1963 (Table 2) is largely due to the increased size of the areas, and to increased hunting pressure on the areas, as measured by the number of hunters and gun-hours and the length of the quail hunting season (Table 2).

The percentage of juveniles in the quail harvest decreased on the Forbes Area from 86 percent in 1963 to 80 percent in 1964. On the Dale Area, however, 87 percent of the harvest in 1964 was composed of juvenile quail compared with 83 percent in 1963. These harvest data, plus the percentage increase over the 1964 prebreeding populations (summer gains: Monthly Wildlife Research Letter, February, 1965), show that the number of quail available to hunters in fall is highly dependent upon reproductive success during the preceding summer. Thus, habitat management should emphasize the development and maintenance of top-quality nesting cover, brood-rearing cover, and other habitat components essential to quail production and brood survival.

Hunting success was generally poorer on both state areas in 1964 as compared with 1963 (Table 2): Seventy-six and 10 percent more gun-hours, respectively, were required to kill a quail on the Forbes and Dale areas in 1964. The kill per hunter declined 55 percent on Forbes and 25 percent on Dale. Hunting success expressed in terms of quail killed per 100 acres showed little change on either the Forbes or Dale areas.

Four methods were used to estimate the percentages of quail harvested on the two areas (Table 3). For the Forbes Area in 1963, the four estimates show good agreement and suggest a harvest on the order of 45 percent of the population. We believe that the harvest in 1964 was about 50 percent of the fall population. The respective figures of 94 and 80 percent (col. 2) for the Forbes and Dale areas in 1964 are too high because the prehunt census was unsatisfactory. In both 1963 and 1964 on the Dale Area, the percentage harvest of quail appears to have been on the order of 65 percent of the fall population.

The above rates of exploitation seem high. Whether they are biologically excessive is a moot question because, as the late Professor Aldo Leopold reported more than 30 years ago, statistics based on experience must be used for determining the percentage of the population which may be harvested on a given area without jeopardizing future populations. More picnicking and camping areas, which are restricted from hunting, are being established on state conservation areas. These restricted zones may provide adequate protection for quail against excessive hunting pressure in the future -- thereby making further restrictions on hunting unnecessary.

Table 2. Harvest statistics for quail on the Forbes and Dale study areas.

Category	Forbes 1963	Forbes 1964	Percent Change	Dale 1963	Dale 1964	Percent Change
Recorded Kill	170	253	+ 49	175	230	+ 31
Percent Juveniles	86	80		83	87	
Hunting Pressure						
Number of Hunters	103	341	+231	139	244	+ 76
Gun-Hours	410	1,074	+162	438	634	+ 45
Season Length (days)	29.5	47.5	+ 61	29.5	47.5	+ 61
Hunting Success						
Gun-Hours per Kill	2.41	4.25	+ 76	2.50	2.76	+ 10
Kill per Hunter	1.65	0.74	- 55	1.26	0.94	- 25
Kill per 100 Acres	11.3	13.4	+ 19	23.6	21.3	- 10

Table 3. Percentage harvests (percent of population killed) of quail on the Forbes and Dale study areas.

Area	Basis of Estimate: Tag Recoveries	Prehunt Census Vs. Kill	Prehunt Census Vs. Posthunt Census	Posthunt Census + Kill Vs. Kill
FORBES				
1963	47	49	42	46
1964	41	94	45	63
DALE				
1963	--	59	69	67
1964	--	80	59	66

5. <u>Responses of Prairie Chickens to Habitat Manipulation</u> R. J. Ellis

Prairie chicken booming grounds tend to be located on traditional sites. However, in southern Illinois it is common for prairie chickens to shift the locations of their booming grounds from year to year. The reasons why booming grounds are moved and the rates at which they are moved are poorly understood. Dr. Ralph E. Yeatter suggested that some booming grounds which he studied were moved because of farming operations.

Information gathered at Bogota from 1963 to 1965 indicates that the locations of booming grounds on that area were changed as a result of farming operations and the location of nesting cover. The booming grounds established on green wheat usually were moved when the wheat grew so tall that the chickens' visibility was restricted.

The grass tracts on Section 28 are the only ones on the study area which support good quality nesting cover. An examination of the booming grounds in this area demonstrates the tendency for booming grounds to be located near grass tracts and for the numbers of cocks per ground to remain highest near the tracts. Each year, the booming ground on Section 21 was moved about 0.25 mile in the direction of the nesting cover on Section 28.

6. Rabbit Management

J. A. Bailey, R. J. Siglin

Autopsy of rabbits found dead along highways or trapped on experimental areas indicates that the 1965 breeding season for cottontails in central Illinois began during the second week of March. Virtually all female cottontails in this area are now pregnant and will bear litters during the first full week in April. These litters will be in nests for about 2 weeks after they are born. The practice of burning grassy areas, ditch banks, and weedy patches should therefore be avoided in central Illinois during the period April 4-24 if rabbit production is being considered.

Cottontails have a 28-day gestation period and usually breed immediately after each litter is born. We can therefore expect other peaks of littering to occur around May 6, June 3, and July 1. Vulnerability of nestling cottontails to burning and mowing will be greatest for about 2 weeks after each of these dates in central Illinois. The dates of littering and the critical periods should be a week earlier in southern Illinois and perhaps a week later in northern Illinois.

As the summer progresses, individual adult female rabbits will stop breeding, but those born in April, May, and perhaps June will begin to breed. It is not known whether the breeding periods of juvenile cottontails are synchronized in the manner described above for adults. Thus, although cottontails may continue to breed until next September, we cannot be sure that there will be synchronized breeding and peaks of littering after July.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois — April, 1965 — Vol. 8, No. 4

1. Pheasant Populations and Land Use

S. L. Etter

A total of 137 dead embryos were found among fertile eggs in 57 of 214 successful pheasant nests observed on the Sibley Study Area during the nesting seasons of 1962, 1963, and 1964. Although 37.0 percent of the hatched nests in 1964 contained eggs with dead embryos, compared with 25.2 and 26.6 percent in 1962 and 1963, respectively, this difference did not appear to be significant since the percentages of eggs containing dead embryos were essentially the same during the 3 years (7.2, 6.2, and 6.9 percent in 1962, 1963, and 1964, respectively).

The ages of the unhatched embryos varied from 2 to 23 days. Of these embryos, 116 (84.7 percent) were from 17 to 23 days of age and only 21 (15.3 percent) were from 1 to 16 days of age (Table 1). These data suggest that some embryo mortality may be the result of some hens laying one or two eggs after incubation has begun, which do not hatch before the hen and hatched chicks leave the nest.

Table 1. Ages of embryos in unhatched eggs from successful nests, Sibley Study Area, 1962-64. Data are from 57 nests located on 100, 10-acre plots.

Incubation Stage (Days)	Number of Embryos				Percent of Total
	1962	1963	1964	Total	
1 - 8	4	6	0	10	7.3
9 - 16	4	7	0	11	8.0
17 - 23	60	39	17	116	84.7
Total	68	52	17	137	100.0

2. Manipulation of Pheasant Habitat

G. B. Joselyn

The initial test of a chemical defoliate (Ortho Diquat) on $\frac{1}{4}$ mile of roadside during September 1964 to determine its potential for use as a chemical seedbed preparative was described in Monthly Wildlife Research Letter, Vol. 7, No. 10 (October 1964). Chemical defoliates have been used for several years with considerable success in the western part of the United States for pasture renovation, where spraying with the chemicals (to kill the existing vegetation) and seeding are usually combined in the same operation, the sprayer being attached to a specially designed sod seeder. Such chemical defoliates are considered to have great potential in aiding the establishment of roadside seedings over broad areas with a minimum of time and expense.

Weather permitting, two additional chemical defoliates, Ortho Paraquat and Ansar (cacodylic acid), will be tested in early May along a mile of roadside ($\frac{1}{2}$ mile each) in southern Livingston County, 9 miles north of Sibley. Each of these defoliates is reputed to be more effective in eliminating bluegrass than the Ortho Diquat employed last September.

On each $\frac{1}{2}$ mile of roadside, the following two planting techniques will be employed: sod seeder, $\frac{1}{4}$ mile; aerifier followed by Brillion seeder, $\frac{1}{4}$ mile. The sod seeder plants grasses and legumes in established sod in rows of variable width (8" - 20"). It employs a rolling coulter to open the sod ahead of seeding "shoes." Aerifiers are used to expose the soil on bluegrass sod for fertilization or overseeding. It is anticipated that this machine will expose enough soil after treatment with a chemical defoliate to allow seeding with a Brillion or hydroseeder.

Additional seedings employing the above and other machines and various rates of chemical treatment are planned for late summer.

3. <u>Factors Influencing Distribution and Abundance of Pheasants</u> W. L. Anderson

At the inception of the gene pool experiment on the Neoga Study Area, there existed a need for a quantitative method of showing differences and similarities among the various strains of pheasants concerned in the study. With such a method, it was hoped that the progenitorship of pheasants reared on the area could be determined, thereby indicating the released strains most successful in perpetuating their genotypes under the environmental conditions at Neoga. As large numbers of birds were to be handled, it was decided that a few, relatively simple, morphological measurements which could be taken with speed and accuracy would be likely to reveal important relationships among the strains of pheasants.

Measurements taken were: (1) length of closed wing, (2) length of exposed culmen, (3) width of maxilla at nostrils, (4) length of tarsus, (5) length of middle toe, (6) length of middle claw, and (7) length of middle toe and claw. Measurements were taken on almost all 2,662 pheasants released at Neoga during the four winters, 1959-60 through 1962-63, and on about 400 native birds captured by nightlighting or shot by hunters during the fall and winters of 1960-61 through 1963-64. In the final evaluation, 15,636 measurements on released pheasants and 2,678 on native birds were taken and included in the analyses.

It was found that, within each sex and age group, means of wild-Illinois birds tended to be larger than those of the other released strains of pheasants (Table 2). Next, in decreasing size, were wild-Kansas, Korean, California, and Japanese pheasants. There were several exceptions to this general trend; for instance, cocks and hens of Japanese origin had unusually long middle toes and claws, and California birds had unusually short ones.

Comparative data on measurements of native pheasants and released birds suggest that birds hatched on the Neoga Area in 1960, 1961, and 1963 were more closely related to wild-Illinois pheasants, with respect to external morphology, than to the other strains of pheasants released on the area. Measurements of the native birds hatched in 1962 had similarities to those of both wild-Illinois and wild-

Kansas pheasants. Although reduced, the similarities to wild-Kansas birds were still evident the following year. Wild-Illinois birds were released on the area during the winters preceding the breeding seasons of 1960, 1961, and 1963, but not preceding the breeding season of 1962. Measurements of native birds were never closely related to those of Korean, California, or Japanese pheasants. Therefore, according to the morphological measurements taken, selection within the gene pool favored, in a relative sense, the genetic constitutions of wild-Illinois and wild-Kansas pheasants over those of Korean, California, and Japanese pheasants.

Table 2. Means of measurements (in millimeters) of juvenile pheasants released at Neoga, Illinois, December-March, 1959-60 through 1962-63.

Strains of Pheasants	Wing	Exposed Culmen	Maxilla Width	Tarsus	Middle Toe	Middle Claw	Middle Toe and Claw
Juvenile Cocks							
Wild-Illinois	246.1	31.3	13.6	---*	47.6	13.2	60.7
Wild-Kansas	240.4	32.8	13.7	64.9	45.4	13.6	59.0
Korean	230.9	32.4	12.6	64.0	46.1	13.3	59.3
California	234.6	29.8	12.9	---*	46.0	11.5	57.4
Japanese	227.5	32.2	12.5	62.1	46.7	13.9	60.6
Juvenile Hens							
Wild-Illinois	216.2	27.9	11.9	60.3	42.3	11.8	54.2
Wild-Kansas	210.7	28.3	12.0	57.7	40.5	12.5	53.0
Korean	202.9	27.8	10.8	55.3	40.9	11.6	52.5
California	209.6	26.6	11.4	59.4	40.5	10.9	51.3
Japanese	202.5	27.8	11.1	54.3	41.1	11.8	53.0

* Measurements not taken.

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis, R. L. Westemeier

Posthunt censuses of quail in January 1965 produced population estimates of 116, 147, and 57 birds on the Dale, Forbes, and Alma areas, respectively (Table 3). The posthunt population on Dale in 1965 was estimated to be 24 percent greater than in 1964, but on Forbes was estimated to be 27 percent smaller.

The prebreeding populations were estimated to be 42, 74, and 88 birds on the Dale, Forbes, and Alma areas, respectively, in March 1965. These estimates were smaller than those obtained on the areas in March 1964 and represented declines of 9 percent, 37 percent, and 12 percent on the Dale, Forbes, and Alma areas, respectively.

Losses in the quail populations from January to March were greater on the Dale and Forbes areas in 1965 than in 1964 (Table 3), and could be attributed to (1) more emigration from the areas, (2) more adverse weather, and (3) greater habitat deterioration in 1965 than occurred in 1964.

Table 3. Population estimates of quail, obtained from censuses on the Dale, Forbes, and Alma areas in January (posthunt) and March (prebreeding) of 1964 and 1965.

Area	January (Posthunt) 1964	January (Posthunt) 1965	March (Prebreeding) 1964	March (Prebreeding) 1965	Percent change from January to March 1964	Percent change from January to March 1965
Dale	88	116	46	42	-48	-64
Forbes	202	147	117	74	-42	-50
Alma		57	100	88		+54

5. Responses of Prairie Chickens to Habitat Manipulation

R. J. Ellis

The annual census of prairie chickens on booming grounds on 10 selected areas in southern Illinois was conducted during the first 2 weeks of April, 1964 and 1965 (Table 4). Three or more counts were made on each area and the count which included the largest number of cocks was taken as the census figure. All counts were made during the first hour of daylight.

In 1964, 288 prairie chickens (252 cocks and 36 hens) were counted on 34 booming grounds found on the census areas. In 1965, 20 booming grounds were found on the census areas and 189 prairie chickens (163 cocks and 26 hens) were counted. These data indicate a 35 percent reduction of prairie chicken numbers on the census areas from 1964 to 1965. In 1964, the data indicated a 19 percent reduction of prairie chicken numbers on the census areas from 1963 to 1964 (Monthly Wildlife Research Letter, April, 1964). No wildlife population, especially one as small as most prairie chicken flocks in Illinois, can long sustain such large annual losses.

If prairie chickens are to be preserved in Illinois, it is absolutely imperative that substantial measures be taken in 1965 to curb the large annual population

losses. It has been demonstrated that the provision of high quality nesting cover is the management measure needed most (Monthly Wildlife Research Letter, January, 1965).

Table 4. Results of annual censuses of prairie chickens on booming grounds on 10 areas in south-central Illinois during the first 2 weeks of April, 1964 and 1965.

Census Area	Number of Cocks 1964	1965	Percent Change 1964 to 1965	Notes (1965)
Hookdale, Bond Co.	16	13	-19	
Martinsville, Clark Co.	29	17	-41	
Xenia, Clay Co.	16	0	-100	2 ♂ observed March 19
Dieterich, Effingham Co.	10	2	-80	
Bogota, Jasper Co.	65	47	-28	
West Liberty, Jasper Co.	5	7	+40	
Hunt, Jasper Co.	17	8	-53	
Farina, Marion Co.	27	29	+7	11 ♂ observed within 1 mile of census area; 11 of unknown sex observed on census area
Cisne, Wayne Co.	19	9	-53	6 ♂ observed within 1 mile of census area
Mt. Erie, Wayne Co.	48	31	-35	
All Areas	252	163	-35	

6. Rabbit Management

J. A. Bailey, R. J. Siglin

Captures of cottontail rabbits on the Allerton Park 4-H Area during the period December 1964 - March 1965 have indicated that the distribution of overwintering rabbits on the area was far from uniform. Although the distribution of box traps tended toward uniformity, rabbits were caught frequently in some sections of the area and rarely in other sections. Observations of rabbits during drives and of

the distribution of rabbit tracks when snow was on the ground indicated that the distribution of captures could be used to indicate the distribution of rabbit-use on the area. Accordingly, the distribution of rabbit-captures in relation to the habitat permits an evaluation of the winter habitat requirements of cottontails. It is assumed that the habitat needs of rabbits were fulfilled in sections of the 4-H Area where rabbits were frequently caught, and that some required habitat constituent was lacking in the sections where rabbits were seldom caught.

The 4-H Area was divided into 105 square 1-acre blocks for habitat evaluation. The presence or absence of each of the following habitat types was recorded for each block: (1) trees over 15 feet tall with closed canopies, (2) trees over 15 feet tall with open canopies, (3) dense thicket, (4) sparse thicket, (5) annual weeds, and (6) bluegrass. Dense thicket was subjectively defined as a multiflora rose hedge or its equivalent, and almost all of the dense thicket recorded consisted of rose hedges. Sparse thicket included stands of wild rose, *Rubus*, and areas with numerous shrubs and/or small trees. A habitat type was considered present if it occupied at least 400 square feet of the 1-acre block.

There were 214 rabbit-captures on the 4-H Area during December, January, February, and March, 1964-65. The number of captures occurring in each of the 1-acre blocks was noted.

The importance of each of the six habitat types to overwintering rabbits can be evaluated by comparing the numbers of captures occurring in blocks containing a given type with the numbers of captures occurring in blocks in which this type is absent (Table 5). Statistical tests for differences among means were performed on the transformed data, using $X' = \sqrt{X+\frac{1}{2}}$. These tests indicate that significantly fewer rabbit-captures occurred in blocks lacking either dense thicket or sparse thicket. They also suggest that rabbit-captures might be associated with stands of trees with closed canopies or with stands of annual weeds.

If it is concluded that thickets are a necessity in winter rabbit habitat, a more sensitive test of the importance of stands of trees with closed canopies or of stands of annual weeds is provided by considering only the 54 blocks containing dense thicket (Table 6). Statistical tests were again performed on the transformed data. These tests indicate that when dense thicket was present, the presence or absence of stands of trees with closed canopies did not affect the frequency of rabbit-captures, but that the presence of annual weeds was associated with an increase in the number of rabbit-captures.

It is concluded that annual weeds and thickets -- in particular the dense thickets provided by multiflora rose hedges -- are important constituents of the winter habitat of cottontail rabbits on the 4-H Area.

Table 5. Relation of rabbit-captures to presence of habitat types on the Allerton Park 4-H Area, winter, 1965.

Habitat Type	Type Present: Number of Blocks	Type Present: Average Number of Captures	Type Absent: Number of Blocks	Type Absent: Average Number of Captures	Difference in Average Number of Captures	Value of _t_
Trees, closed canopy	75	2.20	30	1.53	0.67	1.24
Trees, open canopy	67	2.21	38	1.66	0.55	0.76
Dense Thicket	54	3.04	51	0.92	2.12	4.47†
Sparse Thicket	88	2.24	17	0.82	1.42	2.13*
Annual Weeds	63	2.31	42	1.57	0.74	1.34
Grass	79	2.06	26	1.84	0.22	0.81

* Significant at 95 percent level of confidence.
† Significant at 99 percent level of confidence.

Table 6. Relation of rabbit-captures to presence of stands of trees with closed canopies and of stands of annual weeds, December 1964 - March 1965. Dense thickets are present in all 54 blocks considered.

Habitat Type	Type Present: Number of Blocks	Type Present: Average Number of Captures	Type Absent: Number of Blocks	Type Absent: Average Number of Captures	Difference in Average Number of Captures	Value of _t_
Trees, closed canopy	44	3.12	10	3.00	0.12	0.20
Annual Weeds	33	3.70	21	2.00	1.70	2.49*

* Significant at 95 percent level of confidence.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois May, 1965 Vol. 8, No. 5

1. Pheasant Populations and Land Use

S. L. Etter

Roadside observations of the behavior of pheasants on the Sibley Study Area indicate that the peak of breeding in 1965 probably occurred the week of May 7-13. During this week nearly 50 percent of all groups of pheasants observed were harems, the highest percent since cocks began establishing territories in early April. The peak of breeding in 1965 occurred during the same week as in 1964 and 1 and 2 weeks later than the peaks in 1963 and 1962, respectively. The delay in reaching this stage in reproductive behavior in 1965 may have been the result of a delay in the onset of the establishment of cock territories. Cocks apparently did not establish territories until the week of April 2-8 in 1965, probably because of the heavy snowfall in March, which tended to maintain winter flocks. In 1962, 1963, and 1964 cocks began to establish territories the weeks of March 12-18, March 5-11, and March 26-April 1, respectively.

The peak of nest establishment in 1965, as indicated by a sharp increase in the percent of all groups observed that were unisexual groups of hens, probably occurred the week of May 14-20. The peaks of unisexual groups of hens occurred the weeks of May 21-27, May 7-13, and May 14-20 in 1962, 1963, and 1964, respectively. The peaks of nest establishment, based on the peaks of unisexual groups of hens, were in good agreement with the dates of establishment of nests found on the sample plots during the nesting seasons of 1962, 1963, and 1964.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

As part of an extensive habitat manipulation program, the periodic mowing of a 1-yard strip of vegetation along the road edges of seeded plots to improve their appearance may be desirable or even necessary from the standpoint of public relations. Therefore, some assessment of the distribution of the nests on the roadside plots must be made so that in future management programs these strips may be mowed in such a way as to have a minimum effect on nesting.

Data from pheasant nests located on seeded roadside plots show that during both 1963 and 1964 the average distance of pheasant nests from the road edges for plots without fences was less than for plots with fences (Table 1). The average distance of nests from the road edges on plots with fences remained almost constant during both years, but was variable on plots without fences.

The data show that establishment of nests tended to be closer to the road edges in 1964 than in 1963. Thus, in 1963, 20.5 percent of the 44 nests located on seeded plots were established between 0.0 and 8.7 feet from the road edges, compared with

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35.3 percent established within this range in 1964. Because the average distance from nests to road edges on plots with fences was essentially the same in 1963 and 1964 (11.7 and 12.0 feet, respectively), this difference between the 2 years can apparently be largely accounted for by the change in the average distance from road edge to nest on the plots without fences, from 10.2 feet in 1963 to 7.2 feet in 1964 (Table 1).

From the standpoint of mowing a 1-yard strip along seeded plots, data show that 1 of 44 nests (2 percent) would have been located in the 1-yard strip in 1963, and that 5 of 88 nests (6 percent) fell within this strip in 1964. Data from additional years are needed before definitive statements can be made concerning the percent of established nests which would normally be lost by mowing a 1-yard strip along the edge of a seeded roadside. Possible effects of mowing along the road edges on the nesting of pheasant hens in the unmowed remainder of the seeded roadsides were not evaluated.

Table 1. Mean distances of pheasant nests from road edge, field edge, and fence (when present), and mean widths of seeded and managed control roadside plots, Sibley Study Area.

Type of Plot	1963				1964			
	Mean Width of Plots (Feet)	Mean Distance of Nests from--			Mean Width of Plots (Feet)	Mean Distance of Nests from--		
		Road Edge (Feet)	Field Edge (Feet)	Fence (Feet)		Road Edge (Feet)	Field Edge (Feet)	Fence (Feet)
Seeded								
Plots without Fences	16.3	10.2	9.6	-	13.4	7.2	9.9	-
Plots with Fences	18.1	11.7	11.4	8.4	17.5	12.0	10.2	7.8
Managed Control								
Plots without Fences	16.1	9.3	10.5	-	15.5	13.2	6.6	-
Plots with Fences	17.8	14.7	9.3	6.9	17.9	15.0	8.7	5.1

3. <u>Factors Influencing Distribution and Abundance of Pheasants</u> W. L. Anderson

During May 1965, the population of breeding pheasants on the Neoga Release Area was estimated to contain 67 birds (28 cocks and 39 hens). This estimate was obtained by multiplying the number of cocks located by observation and audio-triangulation (28) by the average of the maximum number of hens observed in harems

of individual cocks (1.4). This estimate indicated that the population was 68 percent larger in May 1965 than during the same period in 1964, and that 62 percent of the 63 hens on the area during October 1964 survived to the following May. In the 4 previous years, October to May survival among hens at Neoga averaged only 28 percent (Table 2).

Admittedly, pheasants on the area are presently at a critically low level of abundance. Nevertheless, the recent findings are encouraging. It is possible that, through the mechanics of population genetics, a pheasant adapted to the environmental conditions characteristic of south-central Illinois might be developing on the Neoga Area.

Table 2. Percent survival of pheasants from October to the following May, 1960-61 through 1964-65, Neoga, Illinois.

Year	Percent Survival	
	Cocks	Hens
1960-61	26	24
1961-62	39	30
1962-63	22	34
1963-64	17	22
1964-65	44	62

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis, R. L. Westemeier

Common ragweed, Korean lespedeza, and acorns, in that order, were the food items found most frequently in the crops of quail harvested on the Dale and Forbes areas, combined, in both 1964 (Table 3) and 1963 (Monthly Wildlife Research Letter, October, 1964).

The food patches established on the areas in 1964 as part of the management program contained essentially the same foods as in 1963: corn, wheat, milo, buckwheat, and several millets. Buckwheat, German millet, and milo ranked among the first 10 foods according to frequency of occurrence in crops from the Dale Area. Buckwheat, German millet, corn, wheat, and milo ranked among the first 10 foods in crops from the Forbes Area.

During the posthunt census on Forbes in mid-January 1965, snow covered the ground to depths of 4-5 inches, and tracking conditions were excellent. Quail would be expected to utilize food patches during such periods of adverse weather. A check was made of 190 of the 221 food patches for evidence of use by quail. Three food patches had tracks indicating use by single quail; one food patch showed evidence of use by a covey of quail. Five of the 19 coveys found during the posthunt census were feeding on Korean lespedeza, black locust (Robinia pseudoacacia), ash, coralberry (Symphoricarpos orbiculatus), and soybeans. The value of the food patches established annually on the areas as sources of food for quail can be questioned, in view of their limited utilization by quail.

Table 3. The 10 top-ranked food items (percent occurrence) found in crops of quail harvested on the Dale and Forbes areas in 1964. The Dale sample represents 184 crops (18 empty); the Forbes sample, 226 crops (27 empty).

Food Items	Times Represented	Percent Frequency of Occurrence	Rank
		Dale Area	
Oaks (*Quercus* spp.)	78	42	1
Korean lespedeza (*Lespedeza stipulacea*)	71	39	2
Common ragweed (*Ambrosia artemisiifolia*)	58	32	3
Ash (*Fraxinus* spp.)	42	23	4
Small wild bean (*Strophostyles leiosperma*)	41	22	5
Buckwheat (*Fagopyrum sagittatum*)	38	21	6
German millet (*Setaria italica*)	31	17	7
Stick-tights (Beggar-ticks) (*Bidens* spp.)	26	14	8
Milo (*Sorghum vulgare*)	22	12	9
White sassafras (*Sassafras albidum*)	16	9	10
		Forbes Area	
Common ragweed (*Ambrosia artemisiifolia*)	106	47	1
Korean lespedeza (*Lespedeza stipulacea*)	62	27	2
Buckwheat (*Fagopyrum sagittatum*)	51	23	3
Ash (*Fraxinus* spp.)	48	21	4
Soybean (*Glycine max*)	46	18	5
Smooth crabgrass (*Digitaria ischaemum*)	37	16	6
German millet (*Setaria italica*)	35	15	7
Corn (*Zea mays*)	34	15	8
Wheat (*Triticum aestivum*)	30	13	9-10
Milo (*Sorghum vulgare*)	30	13	9-10

5. Responses of Prairie Chickens to Habitat Manipulation R. J. Ellis

Prairie chicken numbers in Illinois have been so reduced (Monthly Wildlife Research Letter, April, 1965) that the success of each nest is very important if the species is to be preserved in Illinois. To increase the number of successful nests on the Bogota Area, the Illinois Department of Conservation provided funds for leasing those portions of fields where prairie chicken nests would otherwise be destroyed. The Natural History Survey operated a flush bar which was driven over each field considered for leasing, so that only fields containing active prairie chicken nests would be leased.

Wheat stubble fields totaling 262 acres were searched with the flush bar from May 1 to May 14, 1965. Most of these fields also contained stands of red clover. No prairie chicken nests were found. Likewise, 10 acres of undisturbed tall fescue yielded no prairie chicken nests.

The flush bar was also operated in a 6-acre field of second-year timothy. Previously, the farmer had plowed a 2-acre strip in the center of this field and thereby destroyed a nest containing five eggs. The 2-acre strip of timothy south of the plowed portion yielded no nests. The remaining unplowed strip yielded one nest with 11 eggs before one-eighth of the field had been covered. The remainder of the strip was not searched for fear of disturbing other nests. The unplowed strip of timothy containing the nest was leased by the Illinois Department of Conservation.

6. Rabbit Management J. A. Bailey, R. J. Siglin

October populations of cottontail rabbits on the Allerton Park 4-H Area were much larger during the years 1956 through 1961 than during 1962 through 1964 (Monthly Wildlife Research Letter, November, 1964). During the first 6 years, October populations averaged 314 rabbits; during the last 3 years, about 130 rabbits. It has been assumed that changes in the habitat have been responsible for this change in the cottontail-productivity of the 4-H Area. A specific assumption has been that some important component of the habitat is no longer present in sufficient quantity to maintain the October 1956-61 level of cottontail-productivity.

Habitat changes on the 4-H Area during the 1956-64 period were assessed by examining aerial photographs taken each year in late summer. There appears to have been no sudden change in the habitat that would account for the sudden change in fall populations between 1961 and 1962. Changes seem to have been gradual and due to plant succession. (Sudden changes in the habitat that were not detectable on nonstereoscopic aerial photographs may have occurred.)

Habitat changes on the 4-H Area were quantified by examining the 1956, 1960, and 1964 aerial photographs. The habitat was divided into broad vegetation-types and the amount of each type present on the area in each year was noted (Table 5). The major change has been a decrease in the amount of land supporting stands of annual weeds and an increase in the amount of land supporting stands of trees in various stages of crown-closure. Apparently, stands of annual weeds have been important to reproductive success and/or to survival of juvenile rabbits on the

4-H Area. Stands of annual weeds may have provided nesting cover or rearing cover for rabbits; or, they may have produced some quantity or quality of food that enhanced reproductive success and survival. Whatever specific need of the cottontail rabbit was fulfilled by these stands of weeds apparently was important to reproduction and/or survival of juveniles.

This situation illustrates an important point. The 4-H Area today fulfills some of the commonly used criteria of good game habitat. It has a great variety of habitat types, well interspersed. Many of the currently recommended plantings are present on the area -- pine windbreaks and block plantings, multiflora rose hedges, and a variety of shrubs. A management program based upon the rule-of-thumb practices of creating variety and edge-effect might produce this kind of habitat. However, the area is now producing less than half the fall population of cottontails that it once produced. Apparently, this is because the variety of habitat types present -- no matter how well interspersed -- has not provided something needed for high reproductive success and/or survival of cottontails during the summer and early fall. That needed something seems to have been contained in stands of annual weeds.

Table 5. Habitat changes on the Allerton Park 4-H Area, 1956-64.

Habitat Type	Percent of Area in Each Habitat Type		
	1956	1960	1964
Annual Weeds	46	28	8
Grass	20	27	25
Shrubs and Hedges	6	7	7
Successional Land*	9	16	35
Forested Land†	19	22	24

* Areas in which trees were large enough to be evident on aerial photographs but did not form a closed canopy were designated as successional land.

† Areas in which trees formed a closed canopy were designated as forested land.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois June, 1965 Vol. 8, No. 6

1. Pheasant Populations and Land Use

S. L. Etter

Pheasant nesting in strip cover and nonagricultural areas has been more successful in 1965 than in 1964. Of 55 nests found thus far (June 25) in these two cover types, 13 have hatched and 7 more are active, with hens either laying or incubating. In 1964, only 11 of 91 nests found in strip cover and nonagricultural areas were successful.

The higher success rate of pheasant nesting in 1965 appears to be the result of two factors: a lower rate of nest abandonment and/or predation and later mowing of roadsides than in 1964. These factors are probably attributable to above normal rainfall during the spring months, which resulted in good quality nesting cover and delayed row crop planting and, consequently, the mowing of roadsides.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

In 1965, the first search for pheasant nests on manipulated and on managed control plots along 8 miles of roadway on the Sibley Study Area started on June 15 and was completed on June 23. Fifty-seven pheasant nests were located on the plots, 35 on seeded plots and 22 on managed control plots. During the first search (June 10-17) in 1964, 85 nests were located, 52 on seeded plots and 33 on managed control plots. In 1963, 85 nests were located in three searches of the roadsides, 44 nests on seeded plots and 41 on managed control plots.

By June 30, 1963, nine of the pheasant nests established on seeded plots had hatched and one hen was still incubating, compared with four hatched nests and one incubating hen on managed control plots (Table 1). As of June 26, 1964, four of the pheasant nests established on seeded plots had hatched, and five hens were still incubating; on the managed control plots, one nest had hatched and three hens were still incubating. By June 26, 1965, eight nests on seeded plots had hatched, and four hens were still incubating; on managed control plots two nests had hatched and six hens were still incubating. Since the first search of the roadsides in 1963 was completed on June 5, and the first searches in 1964 and 1965 were completed on June 17 and 23, respectively, the 1964 and 1965 data are not strictly comparable with the data from 1963. The data thus far obtained for 1965 indicate that nest densities on both seeded and managed control plots for the year will probably be lower than nest densities in 1964. The data also indicate that production of hatched nests on seeded plots may possibly be higher in 1965 than in 1964 (14 hatched nests). Managed control plots, with two hatched nests and six hens still incubating, may also produce more hatched nests than in either 1964 (5 hatched nests) or 1963 (7 hatched nests). The second and final search for pheasant nests on the roadside plots this summer (1965) will be conducted in mid-July.

Table 1. Status of pheasant nests on manipulated and on managed control roadside plots along 8 miles of roadway, Sibley Study Area, June 30, 1963; June 26, 1964; and June 26, 1965.

Status of Nests	Number of Nests					
	Seeded Plots			Managed Control Plots		
	1963	1964	1965	1963	1964	1965
Hatched	9	4	8	4	1	2
Active	1	5	4	1	3	6
Abandoned and/or Destroyed	17	43	23	22	29	14
Total	27	52	35	27	33	22

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

Several investigators have suggested that late-summer mortality among adult hen pheasants might be of sufficient magnitude in some years to suppress materially the fall population of this species. Mortality of adult hens is reportedly associated with stresses arising from nesting and brood-rearing activities, and subsequent molt. It was therefore speculated that, if late-summer losses of adult hens were excessive and/or recurred frequently, they might play an important role in preventing the establishment of pheasants on the Neoga Study Area, located south of the range now occupied by this species. One manifestation of excessive losses of hens in late summer would be the occurrence of an atypically high number of orphan broods, especially during the latter part of the brooding season. Data obtained by observing broods at Neoga from 1960 through 1964, however, indicated that broods not accompanied by hens did not occur in disproportionately high numbers (Table 2). Ninety-three percent of 89 broods less than 6 weeks of age, observed in both early and late summer, were accompanied by hens. Although reduced, the proportion of older broods accompanied by hens was not atypically low; hens in the established pheasant range begin leaving their broods when the chicks are 6 - 8 weeks old. When each age-class was considered separately, the proportion of older broods accompanied by hens did not decrease with any degree of consistency as summer progressed. When all age-classes were considered collectively, the proportion of broods accompanied by hens decreased from June to August (Table 2). It seems probable that this decrease was caused primarily by hens abandoning their broods, whose average age increased as summer progressed, and not by excessive losses among the hens. These findings suggest that the rate of mortality among brooding hens in late summer is no greater at Neoga than within the established pheasant range and is therefore probably not an important factor in preventing the establishment of self-maintaining populations of pheasants in south-central Illinois.

Table 2. Percentage of pheasant broods, observed at various ages, that were accompanied by hens, Neoga, Illinois, 1960 through 1964. Numbers of broods observed are in parentheses.

Age (in weeks)	Date Broods Were Observed				
	June	July	August	Sept.	All Months
0-3	100(18)	100(6)	100(3)	(0)	100(27)
4-5	89(19)	91(32)	100(5)	83(6)	90(62)
6-7	0(2)	53(49)	86(14)	100(2)	60(67)
8-9	(0)	68(34)	43(35)	0(3)	53(72)
10-11	(0)	50(4)	54(24)	50(2)	53(30)
All Ages	90(39)	69(125)	59(81)	62(13)	69(258)

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis, R. L. Westemeier

Information on the age structures of the quail populations on the Forbes, Dale, and Alma study areas was collected during the fall harvest of 1964 and the spring trapping period of 1965. The spring trapping was done with cock-and-hen traps, using hen quail as bait, which accounts for the large proportion of cocks in the spring samples (Table 3).

The proportions of adult males in the quail populations on all three study areas decreased from fall to spring (Table 3), thus indicating an age differential in wint..r mortality. The consistency of this overwinter shift to smaller proportions of adult males implies that the difference in survival rates was probably not related to habitat, because the quantity and quality of quail habitat differ markedly among the three areas. The chi-square test was applied to the data on proportions of adult and juvenile cocks in the populations to determine whether differences in age ratios were significant. Highly significant differences were detected ($P < 0.005$; $x^2 = 22.21$, 9.78, and 79.45 for the Forbes, Dale, and Alma areas, respectively; df=1).

Calculations of differential survival rates of age-classes (cocks) were made with the use of the following formula,

where

N_{sb} = number of juveniles during the fall period,

N_{si} = their survival rate,

N_{sc} = number of juveniles surviving at the end of the winter period,

N_{ob} = number of adults during the fall period,

N_{oi} = their survival rate,

N_{oc} = number at the end of the winter period,

or

$$\frac{N_{sb}}{N_{ob}} \cdot \frac{N_{si}}{N_{oi}} = \frac{N_{sc}}{N_{oc}} \quad .$$

Thus, juvenile bobwhite cocks had survival rates of 1.70, 1.58, and 1.82 times those of adult cocks on the Forbes, Dale, and Alma areas, respectively, for the winter period; that is, juvenile cocks survived about $1\frac{1}{2}$ - 2 times as well as adult cocks.

A dominance hierarchy, whereby adult cocks might be less vulnerable than juvenile cocks to capture by cock-and-hen traps, could be a source of bias in the May-June age ratio. However, adult cocks were captured throughout the trapping period as regularly as were juvenile cocks.

Sample sizes for hens were insufficient for determining overwinter survival rates.

Table 3. Age ratios (by sex) of bobwhites, obtained from fall harvests (November - December) and cock-and-hen trapping (May-June). Sample sizes are in parentheses.

Area	Cocks		Hens	
	Juvenile	Adult	Juvenile	Adult
Forbes				
1964				
November-December	75.0(87)	25.0(29)	84.6(110)	15.4(20)
1965				
May-June	83.6(56)	16.4(11)	80.0(4)	20.0(1)
Dale				
1964				
November-December	84.2(80)	15.8(15)	88.8(95)	11.2(12)
1965				
May-June	89.4(59)	10.6(7)	100.0(4)	0.0(0)
Alma				
1964				
November-December	78.6(11)	21.4(3)	72.2(13)	27.8(5)
1965				
May-June	87.0(40)	13.0(6)	0.0(0)	100.0(1)

5. Responses of Prairie Chickens to Habitat Manipulation R. J. Ellis

The numbers of prairie chickens on booming grounds on the Bogota Study Area in 1965 reached a peak about April 9 (Table 4). Corresponding dates in 1964 and 1963 were April 9 and April 5, respectively.

These data indicate that the peak of the booming season can be expected during the second week of April. Booming ground censuses should be conducted during this period.

Table 4. Numbers of prairie chickens on booming grounds, Bogota Study Area, 1965.

Date of Count	Cocks	Hens	All
March 13	38	0	38
March 20	39	0	39
March 27	37	0	37
April 2	42	1	43
April 3	26	6	32
April 6	31	6	37
April 9	47	6	53
April 16	31	4	35
April 24	27*	2*	29*

* Counts not reliable because of concealing vegetation.

6. Rabbit Management

J. A. Bailey, R. J. Siglin

During May and June 1965, 11 plant species were offered to young cottontails to determine relative palatabilities of these species. Rabbits between 3 and 7 weeks old, from four litters, were used in the tests. The animals, obtained as nestlings during April and May, were kept in groups of three to seven in cardboard boxes. Tests were begun when the rabbits would readily eat fresh plant material and after they had been exposed to all of the test species. All food was removed from the boxes 1 - 2 hours before the rabbits were given 25 grams of each of two plant species. Freshly-cut leaves or leaves and stems were used. After 30 minutes the remainder of the food was removed from the boxes and the consumption of each species was determined. Each of the 11 plants was tested against the other 10. Palatability was rated by the number of times a species was preferred during the ten tests (Table 5). Among the species tested, dandelion and prickly lettuce were highly preferred; giant ragweed, red clover, Rugel's plantain, smartweed, and curly dock were rated as preferred; and wild carrot, crabgrass, common ragweed, and lamb's-quarters were least acceptable.

Table 5. Relative palatability of 11 plant species to young cottontail rabbits.

Test Species	Palatability Rating
Dandelion (*Taraxacum officinale*)	9
Prickly lettuce (*Lactuca scariola*)	9
Giant ragweed (*Ambrosia trifida*)	7
Red clover (*Trifolium pratense*)	6
Rugel's plantain (*Plantago rugelii*)	6
Smartweed (*Polygonum pensylvanicum*)	6
Curly dock (*Rumex crispus*)	5
Wild carrot (*Daucus carota*)	3
Crabgrass (*Digitaria sanguinalis*)	3
Common ragweed (*Ambrosia artemisiifolia*)	1
Lamb's-quarters (*Chenopodium album*)	0

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois July, 1965 Vol. 8, No. 7

1. Pheasant Populations and Land Use

S. L. Etter

As of July 25, 1965, only 96 pheasant nests, 20 of them successful, had been located on the 100, 10-acre sample plots, Sibley Study Area. Corresponding figures for 1964 were 209 nests, 19 of them successful (Monthly Wildlife Research Letter, July, 1964).

The above data, plus the fact that 12 pheasant broods have been observed along 240 miles of standardized roadside transect during July 1965, compared with 16 broods recorded for the same number of miles in 1964, suggest that pheasant production on the Sibley Study Area in 1965 may nearly equal that of 1964 despite the lower breeding population in 1965. (Monthly Wildlife Research Letter, March, 1965: The prebreeding population declined from 4,043 in 1963 to 1,684 in 1965; no aerial census was made in 1964.)

2. Manipulation of Pheasant Habitat

G. B. Joselyn

The second and final search was made for pheasant nests on manipulated and on control roadside plots along 9 miles of roadway on the Sibley Study Area from July 19 to 22; the first search took place June 15 - 23 (Monthly Wildlife Research Letter, June, 1965). Eighty-five pheasant nests were located on the plots during the two searches, 52 (2.5 nests per acre) on seeded plots and 33 (1.6 nests per acre) on control plots (Table 1). In 1964, 68 nests (3.8 nests per acre) were located on seeded plots and 38 (2.1 nests per acre) on control plots. Forty-four nests (2.9 nests per acre) were located on seeded plots in 1963, and 41 nests (2.7 nests per acre) were located on control plots (Table 1).

Thus, nest densities on seeded plots in 1965 decreased by 1.3 nests per acre from 1964, but only by 0.4 nest per acre from 1963. The decrease in nest density on control plots was 0.6 nest per acre from 1964 to 1965 and 1.1 nests per acre from 1963 to 1965. The relatively low nest densities on both seeded and control plots in 1965 were at least partially the result of the low breeding population on the study area (Monthly Wildlife Research Letter, March, 1965).

The 0.7 hatched nest per acre on seeded plots in 1965 was the lowest density of hatched nests for the 3 years 1963-65, whereas the density of hatched nests on control plots in 1965 (0.4 hatched nest per acre) was higher than in 1964 (0.3 hatched nest per acre) but lower than in 1963 (0.5 hatched nest per acre).

Table 1. Numbers of established and of hatched pheasant nests and numbers of established and of hatched nests per acre on seeded and on control roadside plots, Sibley Study Area, 1963-65.

	Acres		Number of Established Nests		Number of Established Nests per Acre		Number of Hatched Nests		Number of Hatched Nests per Acre	
	Seeded	Control	Seeded	Control	Seeded	Control	Seeded	Control	Seeded	Control
1963	15.4	15.0	44	41	2.9	2.7	17	7	1.1	0.5
1964	17.9	17.7	68	38	3.8	2.1	14	5	0.8	0.3
1965	20.5	20.2	52	33	2.5	1.6	15	8	0.7	0.4

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

One of the purposes of conducting intensive investigations on the experimental release area at Neoga in recent years (1960-65) was to determine the degree of success attained by pheasants of various strains in reproducing under the environmental conditions that prevailed on the area. The proportion of hens observed during the summer months (preferably July and August in Illinois) that is accompanying broods is one indication of reproductive success of pheasants. At Neoga, the proportion of all hens observed during July and August that was accompanying broods was 56 percent for the 4 years 1960 through 1963 (Table 2). When the various strains were considered separately, it appeared that native hens (birds reared on the area) were more successful in producing broods than were hens of strains released on the area. Among the introduced pheasants, wild-Illinois hens appeared the most successful in reproducing. The few California, Japanese, and wild-Kansas hens that survived to July and August apparently had experienced poor reproductive success. Only 35 percent of the hens of strains from game-farm stock (California, Korean, and Japanese), as compared with 52 percent for wild-transplanted hens (wild-Illinois and wild-Kansas) and 61 percent for native hens, were observed accompanying broods during July and August (Table 2). The findings demonstrate that, as a group, game-farm pheasants were not as successful as wild-reared pheasants in reproducing under the rigors of a wild environment.

Table 2. Percentages of hen pheasants observed (including repeat observations of individual birds) during July and August that were accompanying broods, Neoga, Illinois, 1960 through 1963. Numbers of hens observed are in parentheses.

Strains of Pheasants	Years 1960	1961	1962	1963	All Years	
California	29(7)*	(0)*	33(3)*	(0)	30(10)	35(17)
Korean	----	---	----	50(6)*	50(6)	
Japanese	----	---	0(1)*	(0)*	0(1)	
Wild-Illinois	58(71)*	40(10)*	(0)	33(15)*	52(96)	52(97)
Wild-Kansas	----	---	0(1)*	(0)	0(1)	
Native	----	82(34)	68(25)	49(70)	61(129)	
Undetermined	100(1)	(0)	83(6)	25(4)	64(11)	
All Strains	56(79)	73(44)	64(36)	45(95)	56(254)	

* Pheasants of these strains were released the preceding winter.

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis, R. L. Westemeier

Counts of calling quail made on the Forbes, Dale, and Alma areas from early May until mid-July, 1965, provided a means for comparing populations of whistling bobwhites with those of preceding years (Table 3).

On the Forbes Area in 1965, the average number of cock quail heard to call at each of 11 stops ranged from 0.2 to 2.5 (Table 3) during the spring - summer period (May 6 - July 14). Although the data for 1963 and 1964 are not strictly comparable with the data for 1965, the maximum counts declined from 6.4 in 1963 to 5.5 in 1964 and to 2.5 in 1965. By this measure, the number of whistling cocks on Forbes in 1965 was 55 percent less than in 1964 and 61 percent less than in 1963.

On the Dale Area in 1965, the average number of cock quail heard to call at each of 12 stops ranged from 1.8 to 6.3 (Table 3). The maximum count of 6.3 in 1965 is 6 percent lower than the maximum count in 1964 (6.7), but is 13 percent higher than the 1963 maximum (5.5).

On the Alma Area, the average number of cocks heard to call at each of 20 stops ranged from 1.4 to 4.2 in 1964 and from 0.7 to 3.2 in 1965, the maximum count declining by 24 percent.

Several investigators have shown that the numbers of whistling cocks in summer are not necessarily predictive of fall populations. However, since the decline in the numbers of whistling males on the Forbes Area is severe, the autumn population on this area is likely to be smaller than in 1963 and 1964. On the basis of the May-July whistle counts, the reproductive potential of quail on the Dale and Alma areas in 1965 is, respectively, relatively equal to and somewhat less than the reproductive potential in 1964 (both areas) and 1963 (Dale).

Table 3. Average numbers of cock quail heard during 2 minutes of listening at each predetermined stop on the Forbes, Dale, and Alma study areas. The numbers of stops used each year are in parentheses

	Cock Quail Heard per Stop				
	May		June		July
Area	1 - 15	16 - 31	1 - 15	16 - 30	1 - 15
Forbes					
1963 (10)				5.2, 5.5, 6.4	6.0
1964 (8-12)	0.5, 1.3, 3.4	5.3		5.5	4.2, 2.2, 2.8
1965 (11)	1.6, 0.2	0.5, 2.3	1.5, 1.4	2.0, 1.7	2.5, 1.8
Dale					
1963 (10)				5.0, 5.2, 5.0	5.5
1964 (12)	1.0, 2.6, 3.8	5.8, 5.8, 5.2	4.9, 5.0, 5.7, 5.6	5.2, 6.7, 5.7	2.3, 2.6
1965 (12)	4.9, 3.0	3.9, 4.0	4.7, 4.5	6.3, 4.7	3.5, 1.8, 2.5
Alma					
1964 (10*)	1.8, 1.4	2.8, 2.7, 3.9, 3.2	3.1, 3.0, 3.7, 4.2	2.6, 3.6, 3.9	2.8, 2.8
1965 (10*)	0.7, 1.2	1.2, 1.2	3.2, 2.8	1.7, 1.2	1.5, 0.8, 1.3

* There were 20 stops, 10 of which were used each morning (the direction the route was cruised was alternated).

5. Responses of Prairie Chickens to Habitat Manipulation — R. J. Ellis

A blanket of snow 4 - 8 inches deep covered the Bogota Study Area from January 15 to January 19, 1965. During this period, the 5 square miles where prairie chickens were most frequently observed during recent months were traversed, and the activities of prairie chickens, as indicated by signs left in the snow, were noted (Table 4). Approximately 20 miles were traveled. The signs observed indicated that, during this period of snow, the prairie chickens at Bogota roosted in fields of wheat stubble or in idle fields of grass, and fed in corn and soybean stubble fields.

Table 4. Prairie chicken signs observed in the snow on 5 square miles of the Bogota Study Area, January 15-19, 1965.

Cover Type	Percent of Area Searched	Sign Observed
Soybean Stubble	36.3	21 prairie chickens feeding
Corn Stubble	26.4	5 prairie chickens loafing; signs of feeding in 2 fields
Wheat Stubble	11.6	14 prairie chickens loafing; 43 roost forms
Grass Pasture	6.4	No sign observed
Grass*	5.7	33 prairie chicken roost forms
Legumes*	2.6	No sign observed
Other Types	11.0	21 prairie chickens loafing in fencerow

* Idle fields.

6. Rabbit Management — J. A. Bailey, R. J. Siglin

Beginning in May 1965, cover preference tests were run on penned cottontail rabbits, using a Latin-square design for the test plots. Four to five rabbits were kept in a 5/8-acre pen located approximately 3 miles northeast of Urbana, Illinois. The entire pen was mowed regularly except for the cover plots being tested. The test area consisted of four duplicate plots each of grass, forbs, slats, and stakes, forming a Latin-square of 16, 4-foot square plots, with each cover type represented once in each column and row.

The grass plots consisted of 80-90 percent wild rye (*Elymus* spp.) and up to 15 percent *Carex* spp. or bluegrass (*Poa* spp.). Dominant species in the forb plots were wood sorrel (*Oxalis* spp.), *Aster* spp., and common ragweed (*Ambrosia artemisiifolia*). Other species present in the forb plots were curly dock (*Rumex crispus*), daisy fleabane (*Erigeron strigosus*), lamb's-quarters (*Chenopodium album*), prickly lettuce (*Lactuca scariola*), smartweed (*Polygonum pensylvanicum*), and wild parsnip (*Pastinaca sativa*). Neither the grass plots nor the forb plots were

clipped. For slat plots, lengths of ordinary snow fence were suspended horizontally 1 foot above the ground. Vegetation under the snow fence was clipped periodically. On stake plots, pieces of 1 3/8-inch lathe were stuck into the ground at intervals of approximately 10 inches. Vegetation around the stakes was clipped periodically.

The pen was checked 5 days a week and the locations of all rabbits noted. Over an 8-week period the following numbers of rabbit observations were recorded for the cover types tested: grass-18, forbs-43, slats-3, stakes-0. An analysis of variance (Table 5) was made to determine the significance of the results. The F value for rows is significant at the 90 percent level; that for treatments is significant at the 99 percent level. The difference between the number of rabbits observed in grass plots and in forb plots is significant at the 90 percent level of confidence (t=1.94 at 6 df).

The rabbits preferred the forb plots to the grass plots, although both vegetative types were of approximately the same density and height.

Table 5. Analysis of variance of rabbit use of cover plots arranged in a Latin-square.*

Source of Variation	Degrees of Freedom	Mean Square	F Value
Rows	3	1.3751	3.33
Columns	3	0.3889	0.78
Treatments	3	5.0389	12.19
Error	6	0.4133	
Total	15		

$s_{\bar{x}_1 - \bar{x}_2} = 0.4546$

* Square root transformation of data.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | September, 1965 | Vol. 8, No. 9

1. Pheasant Populations and Land Use

W. J. Francis, S. L. Etter

In 1965, as in the previous 8 years (1957-64), nesting data were collected by searching the northwest one-quarter (10 acres) of 100 randomly selected 40-acre plots for pheasant nests; this 1,000-acre sample represented 4.3 percent of the 23,200-acre Sibley Study Area. In 1965, 107 nests were located on this sample and 23 (21.5 percent) of these nests hatched. These data represent a 56.9 percent decrease from the number of established nests (248) and a 20.7 percent decrease from the number of successful nests (29) found on the 1,000-acre sample during 1964.

William J. Francis joined the staff on September 1, 1965, as project leader. Dr. Francis received his Ph.D. degree in zoology from the University of California at Berkeley in September, 1965. He conducted graduate research on the effect of weather on changes in populations of California Quail (Lophortyx californicus).

2. Manipulation of Pheasant Habitat

G. B. Joselyn

Fifteen of 52 pheasant nests (28.8 percent) established on seeded roadside plots in 1965 were successful, as compared with 14 of 68 nests (20.6 percent) in 1964 and 17 of 44 nests (38.6 percent) in 1963 (Table 1). The rate of nest abandonment on seeded plots increased each of the last 2 years, and, at 25.0 percent in 1965, was more than double the rate of the first year (1963) of the study, 11.4 percent. The percent of nests destroyed* by mammalian predators increased from 34.1 in 1963 to 57.3 in 1964 but decreased to 46.1 percent in 1965. Avian predators, farm machinery, humans, and unknown causes accounted for 15.9 percent of the nests destroyed* in 1963, but accounted for only 1.5 percent in 1964 and for none in 1965. Thus, there was relatively little change between 1963 and 1964 in the proportionate losses of nests from destruction* due to mammals, birds, farm machinery, humans, and unknown causes--50.0 percent of the nests in 1963 and 58.8 percent in 1964--but a slight decline in 1965 when these factors affected 46.1 percent of the nests.

On managed control plots, a higher percentage of the established nests hatched in 1965, 24.2 percent (8 of 33 nests), than in either of the preceding 2 years, 17.1 percent (7 of 41 nests) in 1963 and 13.2 percent (5 of 38 nests) in 1964. In contrast to the rate of nest abandonment on seeded plots, the rate on managed control plots decreased from 36.6 percent in 1963 to 21.1 percent in 1964 and to 18.2 percent in 1965. The trend in the percentage of nests disrupted by mammals and other factors was nearly the same as for seeded plots--increasing from 46.3 percent in 1963 to 65.8 percent in 1964 and decreasing to 57.5 percent in 1965.

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* Some of these nests may have been abandoned first.

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Table 1. Fate of pheasant nests (percentages) established on seeded and on managed control roadside plots--Sibley Study Area. Numbers of nests are in parentheses.

Fate of Nests	Seeded Plots			Managed Control Plots		
	1963	1964	1965	1963	1964	1965
Hatched	38.6(17)	20.6(14)	28.8(15)	17.1(7)	13.2(5)	24.2(8)
Abandoned	11.4(5)	20.6(14)	25.0(13)	36.6(15)	21.1(8)	18.2(6)
Destroyed by--*						
Mammalian predators	34.1(15)	57.3(39)	46.1(24)	39.0(16)	57.9(22)	54.5(18)
Avian predators	4.5(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
Farm machinery	2.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
Humans	2.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
Unknown causes	6.8(3)	1.5(1)	0.0(0)	7.3(3)	7.9(3)	3.0(1)
Total	100.0(44)	100.0(68)	99.9(52)	100.0(41)	100.1(38)	99.9(33)

* Some of these nests may have been abandoned first.

3. <u>Factors Influencing Distribution and Abundance of Pheasants</u> W. L. Anderson

Findings during the spring and summer of 1965 suggest that pheasants on the experimental release area at Bellmont declined to drastically low numbers during the past year. In October 1964, the population was estimated, using the Lincoln Index, to contain 239 (138 cocks and 101 hens) pheasants. However, only 21 territorial cocks were located on the area during May 1965. Although an actual estimate of the hen segment of the breeding population was not obtained in 1965, sex ratios among pheasants observed during early March (7 cocks : 7 hens), and during April and May (31 cocks : 10 hens) suggest that hens were no more abundant on the area than cocks. These data indicate that not more than 18 percent of the 239 pheasants present on the area in October 1964 survived to the following May. Similarly, the number of individual broods located on the area decreased from 52 in 1964 to only 11 in 1965, a reduction of 79 percent. Therefore, it is concluded that the pheasant population on the Bellmont Area has declined to so few birds that recovery of the population seems highly improbable.

4. <u>Responses of Bobwhites to Habitat Manipulation</u>
J. A. Ellis, R. L. Westemeier

Measurement of the spatial relationships among quail coveys is one way to gauge the effectiveness of management practices in creating patterns of uniform habitat distribution (Monthly Wildlife Research Letters, May and June, 1964). An R value serves as a quantitative measure of the degree to which the observed distribution departs from random expectation with respect to the distance to nearest neighbor.

The R values listed in Table 2 illustrate the general inferiority of the quail habitat on the Alma Area as compared with the two state areas (Forbes and

Dale). Only in the fall of 1964 on Alma did the generally random distribution of coveys show a significant departure toward uniformity.

If the habitat plantings for quail on the Forbes and Dale areas are effectively improving the quality of the habitat as they mature, a general trend toward uniformity should be detected. Indeed, slightly higher R values are generally evident for the two state areas (Table 2). On Forbes, the R value for the January distribution increased from 1.70 in 1964 to 1.91 in 1965, and for March the R value increased from 1.16 in 1964 to 1.60 in 1965. On Dale, the R values increased from 0.95 to 1.28 in November of 1963 and 1964, respectively, and from 1.50 to 1.74 in March of 1964 and 1965, respectively.

The fact that the highest R values on the state areas were generally found during January and March suggests a more uniform distribution of winter habitat than is true for the fall habitat. Because the quail populations at the time of the fall census are higher than during the posthunt and prebreeding censuses, dispersion of coveys in November should provide the best index to the distribution of quail habitat on an area. Also, the fall distribution of coveys should be indicative of the placement of reproductive habitat, as brood-rearing activities often extend into the fall season.

Table 2. Comparison of R values obtained by measuring distances to nearest neighbors among quail coveys located on the Forbes, Dale, and Alma areas.

Census Period	Forbes	Dale	Alma
Prehunt (Nov.)			
1963	1.36†	0.95 ns‡	---
1964	1.12*	1.28†	1.24†
Posthunt (Jan.)			
1964	1.70†	1.88†	---
1965	1.91†	1.13 ns	0.84 ns
Prebreeding (Mar.)			
1964	1.16 ns	1.50†	0.97 ns
1965	1.60†	1.74†	0.93 ns

* R value is based on an unsatisfactory prehunt census and is therefore probably invalid.

† Significant ($P<0.05$) departure from randomness toward uniformity.

‡ ns = random distribution, with no significant departure toward uniformity.
0.0000 = maximum aggregation.
1.0000 = maximum randomness.
2.1491 = maximum uniformity.

5. Responses of Prairie Chickens to Habitat Manipulation R. J. Ellis

A study of prairie chicken nests on the Bogota Study Area was conducted (1963-65) to gather information on the characteristics of preferred nest sites. Information was gathered on 13 nests established in 1965.

Eight of 11 nests were made of dead grass; the remaining three nests were constructed of mixtures of dead grass and legumes. Eleven of 13 nests were on sites dominated by grasses and two were on sites dominated by legumes.

Nine of 13 nests were located on the highest third of the study area, the remaining four on the third comprising the middle elevation. Nine of 13 nests were on sites with 1 percent or less slope. Only one nest was on a slope as steep as 2 percent.

The coverage index of ten nests examined averaged .93 (93 percent of the ground was shaded at noon) and the range of coverage indices was 0.70 - 1.00.

These data suggest that prairie chickens at Bogota prefer dense growths of grass and the higher elevations for nesting sites.

6. Rabbit Management J. A. Bailey, R. J. Siglin

Hunter-success cards have been collected on the Sam Dale State Park in Wayne County and the Stephen A. Forbes State Park in Marion County during the past two hunting seasons (1963-64 and 1964-65). The success of hunters who visited these two areas specifically to hunt cottontail rabbits is presented in Table 3. (Data concerning hunters who visited the areas to hunt quail only, or both rabbits and quail, are not presented.)

Both areas realized an increase in rabbit-hunting pressure during the 1964-65 season. The recorded numbers of hunter-trips and of hunter-hours in 1964-65 were more than twice those recorded in 1963-64. The number of rabbits harvested on the Forbes Area increased proportionately as hunter success remained about the same as in 1963-64. However, hunter success declined markedly on the Dale Area in 1964-65.

Eye lenses were collected from samples of the harvested rabbits. The age-distributions of these samples are presented in Table 4. Due to the small sample sizes, there are no significant differences among the ratios of juveniles to adults -- neither between areas nor between years. None of these age ratios differ significantly from what is considered normal for cottontails in the Midwest.

In both years, the average date of birth for juvenile rabbits collected on the Dale Area was about 3 weeks earlier than that of juvenile rabbits collected on the Forbes Area. These results suggest that there may be significant differences between the life-equations of these two populations. It is unlikely that such differences would be caused by differences in climate, since the Dale and Forbes areas are only 17 miles apart. It is therefore probable that important habitat differences which affect seasonal rates of mortality and reproduction exist between the Dale and Forbes areas.

Table 3. Success of hunters who visited two Illinois areas specifically to hunt cottontail rabbits, 1963-64 and 1964-65.

	Sam Dale State Park		Stephen A. Forbes State Park	
	1963-64	1964-65	1963-64	1964-65
Total Hunter-Trips	43	85	79	214
Total Hours Hunted	125	344	331	731
Total Rabbits Harvested	133	151	129	363
Rabbits Harvested per Trip	3.1	1.8	1.6	1.7
Rabbits Harvested per Hour	1.1	0.4	0.4	0.5

Table 4. Age-distribution of cottontail rabbits harvested from two Illinois areas, 1963-64 and 1964-65.

	Sam Dale State Park		Stephen A. Forbes State Park	
	1963-64	1964-65	1963-64	1964-65
Number of Rabbits Aged	140	70	114	71
Percent Juveniles in Sample*	81±7	76±10	78±8	87±8
Average Date-of-Birth of Juveniles*	May 7±19 days	May 3±13 days	May 28±23 days	June 1±12 days

* Plus or minus two standard errors.

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois October, 1965 Vol. 8, No. 10

1. Pheasant Populations and Land Use W. J. Francis, S. L. Etter

The majority of pheasants trapped, marked, and released on the Sibley Study Area during the period August 1964-March 1965, and subsequently observed, moved less than 2 miles from the time of marking to the time of the first subsequent observation (Table 1). Only 14.4 percent of the pheasants were observed more than 2 miles from the location of marking, and 73.7 percent were observed 1 mile, or less, from the site of marking. Observations, either of live birds or based on returns of back tags, were made during the period August 1964-August 1965.

Of the 753 pheasants marked during the fall of 1964 and the winter of 1965, 31.4 percent were observed one or more times after trapping, marking, and releasing

Table 1. Numbers of pheasants moving specified distances from original points of capture on the Sibley Study Area. The birds were marked during fall (August-November 1964) and winter trapping (January-March 1965) and were subsequently observed August 1964-August 1965.*

	Numbers of Pheasants for Each Category of Miles Moved from Points of Capture											
	Less Than $\frac{1}{2}$ Mile	$\frac{1}{2}$-1	1-$1\frac{1}{2}$	$1\frac{1}{2}$-2	2-$2\frac{1}{2}$	$2\frac{1}{2}$-3	3-$3\frac{1}{2}$	$3\frac{1}{2}$-4	4-$4\frac{1}{2}$	$4\frac{1}{2}$-5	More Than 5 Miles	Total
Fall Trapping												
Adult ♂♂	9	1										10
Adult ♀♀	32	24	4	4	3	4	2	1	3	1	1	79
Young ♂♂	32	10		1	1	2	1					47
Young ♀♀	15	11	10	4	1	3	1		2	1		48
Winter Trapping												
Adult ♂♂												0
Adult ♀♀	17	5	2				1				1	26
Young ♂♂	7	2	1									10
Young ♀♀	7	2	1	1		2	2	1				16
Totals	119	55	18	10	5	11	7	2	5	2	2	236

* Data are from observations of living birds positively identified in the field and from back tags obtained from hunters and farmers or found by project personnel.

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2. Manipulation of Pheasant Habitat G. B. Joselyn

Of the questions raised regarding the feasibility of seeding roadsides for nesting pheasants, two seem to receive the most attention: (1) the possibility of excessive road kills as a result of the proximity of the seedings to vehicular traffic, and (2) the possibility of the seedings becoming travel lanes for mammalian predators, with a resulting high rate of nest destruction.

During the past three summers, along 9 miles of seeded roadsides on the Sibley Study Area, road kills of pheasants have averaged approximately 1.5 per summer, only about 0.2 kill per mile of seeded roadside per summer. The low level of road kills along seeded roadsides is probably associated, at least in part, with the relatively low rates of speed at which traffic moves over the country roads along which the seedings are established.

While road kills have so far been of little consequence, mammal predation on nests established in the seeded roadsides has been of greater significance. The percentages of established nests preyed upon by mammals were 34.1, 57.3, and 46.1 during 1963, 1964, and 1965, respectively. During the same 3 years, the percentages of established nests destroyed by mammals on the 100, 10-acre plots searched each year in conjunction with studies of pheasant populations and land use were 24.9, 27.8, and 16.8. Because it is impossible in most instances to determine whether or not nests have been abandoned prior to destruction by mammals, it is probably incorrect to assume that predation by mammals was responsible for all these unsuccessful nests on the roadsides or on the 100, 10-acre plots. Mammal predation figures taken by themselves for these 3 years appear to show a significantly higher rate of predation on the seeded roadsides than in other cover types on the study area. Although this is probably the case, other factors should be taken into account. In each of these 3 years farm machinery destroyed 36-39 percent of the nests in the other cover types, but less than 1 percent of the nests on the seeded roadsides. Without this extensive destruction from farm machinery, mammal destruction in the other cover types could be significantly higher. Thus, it is not known whether the discrepancy between the two sets of figures is conditional rather than actual.

The study of mammal destruction of pheasant nests is further complicated by the past practice of merely listing the predator that destroyed each nest as a "large" or "small" mammal, with no attempt made to distinguish among various species of mammals possibly responsible for the destruction. It has been assumed that farm dogs and cats were among the most prominent predators. During 1965, criteria established for diagnosing predators responsible for breaking up ruffed grouse nests were used in an attempt to determine which species of mammals were responsible for nest predation on the seeded roadsides. Of the 24 nests preyed upon by mammals, on the seeded roadsides, 17 (70.8 percent) were judged to have been destroyed by foxes and/or raccoons, 5 (20.8 percent) by skunks, and one each (4.2 percent each) by ground squirrels and unknown mammals. Although it is not suggested that the above criteria are strictly applicable in all instances to pheasant eggs, they appeared to fit to a striking degree most cases of mammal destruction of pheasant nests on roadsides in 1965. The data reveal a complete lack of nest destruction by farm dogs and cats. Because only "wild" predators appear to be implicated in nest destruction, the degree of predation on seeded roadsides may, to some extent, be dependent on the population fluctuations of the primary prey species--in this case foxes and raccoons.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

Every fall a considerable number of pheasants shot during the hunting season are not recovered. This number includes some hens as well as cocks, although only the latter are legal game in Illinois. What happens to these crippled birds? Certainly many of them soon die, either directly or indirectly from the effects of the shot wounds. However, a significant number of the crippled birds survive; fluoroscopic examinations revealed that 24 percent of 153 cocks and 4 percent of 661 hens captured in the better pheasant range in Illinois (Ford, Livingston, and McLean counties) during the winters (posthunt periods) of 1959-60 and 1960-61 carried lead shot. Although 63 percent of the "infected" pheasants carried only a single pellet, as many as 5 or 6 pellets were occasionally found in one bird. Comparative data indicated that mean weights of pheasants carrying shot were no less than mean weights of pheasants not carrying shot (Table 2). Therefore, it is tentatively concluded that the health of those crippled pheasants that survive the hunting season is not greatly impaired by the presence of lead shot in their bodies.

Table 2. Comparisons of mean weights (in pounds) of pheasants carrying lead shot with mean weights of pheasants not carrying shot. The birds were captured by nightlighting in Ford, Livingston, and McLean counties during the winters (post-hunt periods) of 1959-60 and 1960-61. Numbers of birds weighed are in parentheses; "ns" indicates differences were not statistically significant at the 5 percent level.

Sex and Age	Carrying Shot	Not Carrying Shot	Calculated t-Values	Reference t-Values
Cocks				
Juveniles	2.72±0.06(27)	2.75±0.02(82)	0.600 ns	1.982
Adults	2.96±0.08(10)	2.97±0.03(33)	0.125 ns	2.014
Hens				
Juveniles	2.03±0.04(14)	2.01±0.01(349)	0.400 ns	1.960
Adults	2.17±0.07(12)	2.17±0.01(283)	0.000 ns	1.960

4. Responses of Bobwhites to Habitat Manipulation
J. A. Ellis, R. L. Westemeier

Provision for night-roosting cover for quail is essential in any sound management plan for this species. The roosting behavior of quail from the onset of hatching in early summer until the breakup of coveys in late winter involves close spatial associations among individuals of the group. Cover selected by quail for roosting can therefore be considered important to the welfare of the species.

We have used the nightlighting technique to locate groups of roosting quail on Forbes during the fall months. In 1963 we searched 135 acres and located 8 different groups of quail. In 1964, 185 acres were searched, and 5 different

groups of quail were located. Only 4 night-roosting groups of quail were located while searching 425 acres in 1965. The decrease in the numbers of night-roosting groups was associated with an overall decline in the population on the area, as evidenced by the prebreeding censuses and whistle counts. A deterioration of habitat conditions for quail was thought to be among the reasons for the decrease in the population.

In a detailed study of the roosting habitat of bobwhites in southern Illinois it was recommended that management should provide roosting cover for quail and that such cover should be of open canopy, sparse, relatively short, and have a ground surface nearly devoid of duff.

5. Responses of Prairie Chickens to Habitat Manipulation — R. J. Ellis

Declining reproductive success of prairie chickens on the Bogota Study Area is indicated in the reports of broods (Table 3). The decline in the size of prairie chicken broods on this area since 1963 probably is related to a general deterioration of the habitat (Monthly Wildlife Research Letter, December, 1964), especially of nesting and brood-rearing cover.

Table 3. Numbers of young in prairie chicken broods, Bogota Study Area, 1963-65. Numbers in parentheses are sample sizes.

	1963	1964	1965
Average Number of Young Per Brood	8.2(10)	5.8(13)	5.6(8)
Average Age* of Broods in Weeks When Observed	5.4	5.6	4.6

* Aged according to the condition of the molt.

6. Rabbit Management — J. A. Bailey, R. J. Siglin

Results of feeding trials conducted with young cottontail rabbits during July and August, 1965, have been reported (Monthly Wildlife Research Letter, August, 1965). Several animals in this experiment survived long enough on single-species diets to permit evaluations of digestible nutrients in the foods.

Collections of feces and of samples of the foods were begun on the 5th day of feeding trials. Collections were made for 7 days or, in a few cases, until the rabbits died. Reingestion was not prohibited. Moisture, crude protein, and energy were determined for all samples, and digestion coefficients were calculated (Table 4).

Prickly lettuce, because of its high palatability, protein content, and digestibility, is an exceptional food. Chicory is almost as good because it is highly digestible and palatable. Smartweed and red clover, although high in protein content, were low in palatability and were relatively indigestible (see Monthly Wildlife Research Letter, August, 1965, for palatability ratings).

The results for Rugel's plantain were inconsistent and seemed to reflect changes in the plants, due to maturation. One rabbit gained weight and survived on the plantain collected during early July. This sample of plantain was about 75 percent digestible. Two rabbits lost weight and survived only 12 and 9 days, respectively, on plantain collected during the 3rd and 4th weeks of July, respectively. The digestibility of plantain, especially the digestibility of its protein content, decreased as the month progressed.

Seasonal fluctuations in digestibility of plant foods, due to maturation of plant tissues, are well known in livestock feeding. These fluctuations could be important in the food supply of cottontails inhabiting relatively monotonous stands of vegetation. In contrast, there is a great variety of plant species in the luxurious growth of weeds that commonly follows site-disturbance in Illinois. Due to differences in phenology, some of the plant species in these stands of weeds should be in a stage of vigorous growth--which usually results in the most digestible forage -- throughout the summer.

Table 4. Results of digestion trials conducted with young cottontail rabbits, July - August, 1965.

Species	Number of Trials	Crude Protein (% dry wgt.)	Digestion Coefficients Percent			Digestible Nutrients	
			Dry Matter	Crude Protein	Energy	Crude Protein (% dry wgt.)	Energy (cal./gram dry wgt.)
Prickly lettuce *Lactuca scariola*	3	23.4	78	84	73	19.6	3,080
Chicory *Cichorium intybus*	2	18.4	74	76	70	13.9	2,747
Rugel's plantain *Plantago rugelii*							
July 8 - 15	1	16.4	79	75	76	12.2	2,900
July 18 - 25	1	16.6	74	65	70	10.8	2,638
July 26 - 30	1	16.6	67	53	61	8.8	2,244
Smartweed *Polygonum pensylvanicum*	1	23.9	66	50	62	12.0	2,542
Red clover *Trifolium pratense*	1	22.2	50	52	46	11.7	1,967

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | August, 1965 | Vol. 8, No. 8

1. Pheasant Populations and Land Use — S. L. Etter

The standardized counts of pheasant broods, made on the Sibley Study Area during July and August 1965, revealed 28 percent fewer broods than were recorded in 1964 and 45 percent fewer broods than were recorded in 1963. One hundred fourteen broods were observed along 640 miles of roadside transect (two 40-mile routes were driven weekly), compared with 159 broods in 1964 and 207 broods in 1963. Because of a combination of circumstances--higher roadside vegetation, later small-grain harvest, and fewer mornings with optimum dew conditions, than in the 2 preceding years--it is thought that the number of broods observed in 1965 may be somewhat lower than the actual number of broods present on the area. The average size of broods judged to be completely counted was 5.2 chicks, compared with 4.7 chicks in 1964, an increase of 10 percent.

The number of adult pheasant hens observed during July and August along the same 640 miles of roadside decreased from 392 hens in 1964 to 234 hens in 1965 (40 percent). Fifty-four percent of the adult hens observed in 1965 were broodless, compared with 61 percent in 1964.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

Data obtained during the past three summers (1963-65) regarding pheasant nesting ecology on the seeded roadside plots suggest that pheasants may prefer nearly "pure" stands of brome or a mixture of brome and alfalfa, for nesting cover, to the mixture of grasses and legumes now being used. For the past 3 years, a mixture of three grasses (brome, timothy, orchard grass) and two legumes (alfalfa, red clover) has been seeded on all manipulated roadsides. The handling, weighing, and mixing of five types of seed is time consuming and more costly than single-species seeding.

If the apparent preference of pheasants for brome or a brome-alfalfa mixture for nesting cover could be definitely determined, seeding operations would thus be simplified; the possibility of establishing the seedings would be enhanced, under most circumstances; and the more homogeneous appearance presented by the roadside vegetation would have definite public relations value. These considerations would be important if roadside seedings should ever be established over a large area as part of a management plan.

Selective seeding of the various species or combinations of species along segments of roadsides and comparing pheasant nest densities in these seedings over a period of time would be the most desirable way to investigate pheasant nesting-

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cover preferences. However, this method would be impractical because (1) the mileage of roadside planting required to obtain the necessary number of replications of each species or combinations of species would make it difficult to manage these areas and existing seedings with respect to weed control and mowing; (2) statistical problems would arise because the distribution of treated roadsides would involve a large area, where the availability of nesting hens would be variable; and (3) the various cropping patterns adjacent to the seedings could affect nesting densities on roadsides.

In May 1965, arrangements were completed for the Natural History Survey to lease for 5 years a 24-acre field in southern Livingston County, 5 miles east and 3 miles north of Sibley, for the purpose of evaluating pheasant nesting-cover preferences. In early August the field was plowed and disked, and fertilizer was applied on the basis of soil samples taken from various locations throughout the field. Four different seedings were made on August 17, 18, and 20: (1) brome only; (2) brome-alfalfa; (3) brome-alfalfa-red clover-timothy-orchard grass; and (4) alfalfa-red clover. For statistical evaluation of pheasant nesting-cover preferences, the field was divided into 40 plots of approximately 0.6 acre each; 20 plots are located on each side of the long axis of the field, with five replications of each treatment randomly located on each side of the axis. A 10-foot strip between the plots will be kept mowed during the summer months. The plan is to search the entire field for pheasant nests two times each summer, beginning in 1966. Although data on nesting-cover preferences obtained from the field may not be wholly applicable to roadsides, it is nevertheless expected that significant information pertaining to future roadside management will be obtained.

3. Factors Influencing Distribution and Abundance of Pheasants   W. L. Anderson

As in past years (1960-64), pheasant broods were located during the summer of 1965 on the experimental release area at Neoga by observations and by interviews with farmers. Twenty-two individual pheasant broods were located in 1965, as compared with 82, 69, 70, 55, and 14 located, respectively, in 1960, 1961, 1962, 1963, and 1964. Thus, pheasant brood production at Neoga increased 57 percent from 1964 to 1965. However, brood production in 1965 was still far less than during the first 4 years of the study, and pheasants on the area are presently at a precariously low level of abundance.

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis, R. L. Westemeier

Weights were recorded from 191 cock quail captured 309 times on the Dale, Forbes, and Alma areas from May 13 to July 9, 1965 (Table 1). In 1964, 303 weights were recorded from 203 cocks captured during a comparable period. The quail were captured in cock-and-hen traps in both 1964 and 1965.

Mean weights of cocks on the Dale and Forbes areas were similar for the 2 years (Table 1). On Alma, however, the mean weight of cocks in 1964, 168.0 grams, was significantly higher ($P<0.05$) than the mean weight of cocks in 1965, 163.2 grams.

In 1964, the mean weight of cocks on Alma was higher than the mean weights of cocks on Dale and Forbes; this difference in mean weights was statistically significant ($P<0.05$, Duncan's multiple range test). In 1965, however, there was no statistical difference in the mean weights of cocks on the three areas.

Table 1. Mean weights (grams) of cock quail captured on the study areas, May 19-July 20, 1964, and May 13-July 9, 1965.

	Dale		Forbes		Alma	
	1964	1965	1964	1965	1964	1965
Number of Weights Recorded	54	107	180	132	69	70
Number of Individuals Captured	51	67	100	74	52	50
Mean Weight*	163.4±1.5	162.7±1.2	165.6±0.7	164.2±0.2	168.0±1.3	163.2±1.2
Range	142-195	139.4-201.1	135-190	139.7-190.0	143-193	139.5-184.0

* Plus or minus one standard error of the mean weight.

5. Responses of Prairie Chickens to Habitat Manipulation

R. J. Ellis

Nine prairie chickens were located by project personnel on 214 acres of grassland in July and August, 1965, as follows: three nests on the 77-acre Yeatter Prairie Chicken Sanctuary (in 1964, 15 nests were found on this sanctuary; the small number of nests found on the Yeatter Sanctuary in 1965 appeared to be due to a reduced breeding population and to poorer conditions for searching); two nests in a 20-acre timothy meadow 0.5 mile north of the Yeatter Sanctuary; two nests in a 10-acre redtop meadow 0.5 mile northeast of the Yeatter Sanctuary; one nest in an idle 3-acre field of timothy adjacent to the McGraw Prairie Chicken Sanctuary; and one nest in an idle 30-acre field of mixed broom sedge and redtop.

One prairie chicken nest was found by project personnel, and one nest was reported by a farmer, in 40 acres (two 20-acre fields) of the 50-acre area of red clover that was searched. Two more nests were reported by farmers: one in the field of timothy adjacent to the McGraw Sanctuary, and one in fescue on a grassland waterway. The three nests reported by farmers were not seen by the investigators.

No prairie chicken nests were located on the 20-acre McGraw Sanctuary nor in 60 acres of wheat stubble on the Donnelley Sanctuary.

Eight of the 13 nests discussed above (62 percent) were successful. The success of three nests (23 percent) is not known, and two nests (15 percent) were unsuccessful. The nest in the timothy field, reported by a farmer, was destroyed by plowing and another nest was destroyed by haying operations.

Two prairie chicken nests found in May were revisited 30 days later, at which time no signs of eggs were noted, nor were there any signs of nest predation.

Likewise, eggshells from a successful nest in a clover meadow, observed by a farmer, had disappeared when the field was searched 10 days later. Evidence that mice removed eggshells from nests was noted in 1963. Snakes, also, may rob nests and leave no traces of eggshells.

6. Rabbit Management J. A. Bailey, R. J. Siglin

Exploratory feeding trials were conducted with young cottontail rabbits, ranging from 80 to 420 grams in body weight, during July and early August, 1965. Sixteen of the 21 animals used in the tests were livetrapped near Urbana and 5 were hand-raised from nestlings.

The rabbits were confined in cages measuring 8 x 8 x 11 inches. Water and a salt block were available in each cage. Single-species diets were fed to 19 rabbits; 2 animals were starved. During most of the experiment, the leaves and stems of plants were collected daily from several locations near Urbana. Later, plant material was collected at intervals of 2 - 3 days and stored in a refrigerator before feeding. Tests were terminated after 14 days or upon death of the animals.

The rabbits were fed *ad libitum* until it was determined approximately how much of the food they would consume each day. Daily food consumption, survival time, and changes in body weight were recorded (Table 2).

The most nutritious foods, as indicated by survival times and weight records, were also the most palatable, as indicated by daily consumption records. All rabbits survived for 14 days and gained weight on prickly lettuce and chicory, apparently nutritious foods. Rugel's plantain may also be a nutritious food, although results were inconsistent. Red clover and smartweed did not sustain rabbits and their nutritional value is questionable. (Only one rabbit was fed giant ragweed and no conclusions were drawn concerning this food.)

Bluegrass, supposedly an important cottontail food, was poorest of the plants tested. Rabbits fed bluegrass exclusively survived no longer than rabbits without food. Two additional trials were conducted to test further the nutritional value of bluegrass. One rabbit was fed a commercial rabbit food before being put on the bluegrass diet. After the change, it lost weight steadily and died in 4 days. Another rabbit was fed bluegrass with a supplement of starch and sugar. It gained weight for 3 days on this diet. On the fourth day the supplement was removed, and the animal lost weight and died in 2 days. The appearance of the feces of these two rabbits indicated that rabbits cannot digest bluegrass. The indigestibility of bluegrass could explain why studies of cottontail food habits, based upon analysis of feces, have indicated that bluegrass is an important rabbit food.

Table 2. Results of feeding trials conducted with young cottontail rabbits, July-August, 1965.

Dietary Treatment	Number of Rabbits Tested	Average Daily Consumption of Food (% of body wgt.)*	Average Survival Time, Days (max.:14 days†)	Average Daily Change in Body Weight (% of original wgt.‡)
Prickly lettuce *Lactuca scariola*	3	54	14.0	gained 2.1
Chicory *Cichorium intybus*	2	92	14.0	gained 1.2
Rugel's plantain *Plantago rugelii*	3	56	11.7	lost 0.4
Red clover *Trifolium pratense*	3	35	5.0	lost 3.8
Smartweed *Polygonum pensylvanicum*	3	29	4.0	lost 5.6
Giant ragweed *Ambrosia trifida*	1	24	2.0	lost 8.7
Bluegrass *Poa* sp.	4	10	1.2	lost 13.9
Starvation	2	--	1.5	lost 12.3

* Food consumption is expressed as the average fresh-weight of food eaten daily, relative to the body-weight of the animal.

† Rabbits were removed from the experiment after 14 days.

‡ Original weight = weight at beginning of test.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | November, 1965 | Vol. 8, No. 11

1. Pheasant Populations and Land Use

W. J. Francis, S. L. Etter

Captures of pheasants by nightlighting in the Sibley Study Area during October and early November of 1965 totaled 385 birds in 8 nights of trapping. Distribution of captures by sex and age was as follows:

Adult ♂♂--14--3.6%	Juvenile ♂♂--129--33.5%
Adult ♀♀--92--23.9%	Juvenile ♀♀--150--39.0%

The ratio of 3.0 juveniles (both sexes) per adult female gives an index to the rate of production of young. This ratio is the same as in 1964, and is less than has been found in the years prior to 1964, in which it ranged from 3.2 to 5.0. Roadside summer counts of broods and adult hens both showed substantial decreases from previous years, as did the 1965 nesting study (Monthly Wildlife Research Letters, August and September, 1965). From the low numbers of hens, broods, and nests, and the low ratio of young to adult hens, it appears that the recruitment of young was again slight, as in 1964.

The percentage of cocks among the adults in the fall sample decreased from 18.4 in 1964 to 13.2 in 1965. This change indicates a greater relative mortality in cocks than in hens in 1965 than in 1964. Taken in conjunction with the low numbers of hens, broods, and nests observed during the summer, the decrease in relative abundance of cocks is strongly suggestive of a high mortality and a correspondingly small breeding population. With a low recruitment of young in a reduced breeding population, there appears to have been a substantial decrease in the population on the study area from the numbers present in 1964.

The departure of the juvenile sex ratio from unity (86♂♂:100♀♀), although greater than usually found, is not significant.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

Data presented in the October 1965 Monthly Wildlife Research Letter (Vol. 8, No. 10, page 2) showed that during the years 1963-65 there was a higher rate of pheasant nest destruction by mammalian predators on seeded roadsides than in the other cover types on the Sibley Study Area collectively. Further consideration is given here to predation which occurred on the seeded roadsides and in unharvested hayfields on the study area. Unharvested hayfields are felt to be the cover most similar to that which exists on the seeded roadsides.

In 1963, 46 percent of all nests found in unharvested hayfields (38 of 82 nests) searched in conjunction with studies of pheasant populations and land use were preyed upon by mammals; 34 percent of the nests found on the seeded roadsides

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that year (15 of 44 nests) had been preyed upon by mammals. In 1965, 71 percent of the nests found in hayfields (15 of 21 nests) showed mammal predation, compared with 46 percent (24 of 52 nests) on seeded roadsides. No unharvested hay was searched in 1964.

On the basis of these samples, tests indicated no significant difference in the rates of mammal destruction between nests located in hayfields and those on seeded roadsides in 1963 ($X^2_1 = 0.8$; $X^2_{.10} = 2.71$) or 1965 ($X^2_1 = 1.4$; $X^2_{.10} = 2.71$). It can therefore be concluded that data collected to date fail to reveal any significant difference between mammal destruction of pheasant nests on seeded roadsides and in unharvested hayfields. If differences did exist, they were not of sufficient magnitude to be apparent in the available data.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

The prehunt (October 1965) population of pheasants on the experimental release area at Neoga was estimated to be 185 birds as compared with 126 in 1964. These estimates were obtained by interviewing local farmers each year during early November. This estimate of the 1965 prehunt population suggests that the number of pheasants at Neoga increased 47 percent from October 1964 to the same month in 1965 (Table 1) and is in general agreement with the increase noted in the population last spring and last summer. We now feel confident that the population at Neoga is larger than a year ago, even though no additional stock has been released since March 1963.

Table 1. Estimated numbers of pheasants on the experimental release area at Neoga, Illinois, during October, 1960 through 1965.

Year	Number of Pheasants	Technique Used
1960	704	Lincoln Index
1961	649	" "
1962	527	" "
1963	232	" "
1964	126	Farmer Interviews
1965	185	" "

4. Responses of Bobwhites to Habitat Manipulation
J. A. Ellis, R. L. Westemeier

Prehunt censuses of quail coveys, conducted from October 26 to November 11, 1965, revealed moderate to severe declines in the populations on the three study areas. Totals of 206, 203, and 125 quail were counted on the Forbes, Dale, and Alma areas (Table 2), respectively, and represented declines of 23 percent, 29

percent, and 43 percent from the fall populations in 1964. On the Forbes and Dale areas, 41 percent and 32 percent fewer quail, respectively, were found in the fall of 1965 as compared with the fall of 1963, in spite of major increases in the size of the areas. Declines were also noted in the number and average size of quail coveys in 1965 when compared with similar data for 1963 and 1964 (Table 2).

The prehunt populations in 1965 compared with the 1965 prebreeding (March) populations represented increases of 178 percent on Forbes, 383 percent on Dale, and only 42 percent on Alma. In 1964, summer population gains were 129 percent on Forbes, 522 percent on Dale, and 120 percent on Alma.

It is speculated that the combined effects of several factors may have been responsible for the population declines: (1) adverse weather, (2) habitat deterioration, and, perhaps, (3) excessive hunting pressure in 1964.

The weather during the 1965 breeding season was noticeably cooler and wetter than in 1964 and may have resulted in later hatches and/or smaller broods.

The Forbes and Dale areas have changed from marginal farmland to large fields of weeds with undesirable buildups of duff. Many of these fields are now considered too "sod bound" to be useful to quail. The annual food patches and the wheat-legume-grass strips established in 1965 appear to offer too dense cover close to the ground. It seems evident that quail management is more successful on soils of low to moderate fertility, where the problems of rank cover, duff buildup, and woodland encroachment are minimal.

On the Alma Area, 0.75 mile of hedgerows and 11 acres of woodland have been removed since the fall of 1964. Because of the cool, wet summer of 1965, most new legume seedings produced excellent growth following the wheat harvest, and were mowed for hay in late summer. Wheat stubble with a lush stand of legumes does not appear to be good roosting cover for quail. One type of top-quality roosting cover for quail appears to be small grain stubble (12 - 20 inches high) with an admixture of common ragweed, but without a lush stand of clover or other legumes. Numerous fields of this type were available for roosting in 1964, but in 1965 none were available on the Alma Area.

What appears to have been an excessive harvest of juvenile hens in 1964 on the Forbes and Dale areas may also have been responsible for lower numbers of quail in 1965. On Forbes, 87 cocks and 110 hens (1♂:1.26♀♀) comprised the juvenile segment of the 1964 quail harvest; at Dale, the 1964 harvest of juvenile quail was 80 cocks and 95 hens (1♂:1.19♀♀). Also on Forbes, the average size of quail coveys found during the 1965 posthunt (January) census was 7.7 birds. However, 12 coveys averaged 6.2 birds per covey on the most intensively hunted portion of the area (west side). Subsequently, 5 coveys containing 39 quail were found in this portion of Forbes during the 1965 prebreeding (March) census, and this area was noticeably devoid of quail during the summer and fall of 1965. It has been demonstrated that the ability of a covey to withstand cold is directly proportional to its size, with coveys numbering less than 5 birds having little chance of surviving the rigors of winter. This factor, attributable to excessive hunting pressure in 1964, may also have resulted in the lower quail populations in the fall of 1965, especially on the Forbes Area.

Table 2. Acreages, and quail population changes as determined by prehunt censuses, on the Forbes, Dale, and Alma study areas, 1963-65.

Area	1963	1964	1965
FORBES			
Acreage*	1,501	2,193	2,193
No. of Quail	349	268	206
Quail per 100 Acres	23.2	12.2	9.4
No. of Coveys	22	19	14
Quail per Covey	15.9	14.1	14.7
DALE			
Acreage†	740	1,060	1,100
No. of Quail	297	286	203
Quail per 100 Acres	40.1	26.9	18.5
No. of Coveys	17	18	14
Quail per Covey	17.5	15.9	14.5
ALMA			
Acreage	----	6,000	6,000
No. of Quail	----	220	125
Quail per 100 Acres	----	3.7	2.1
No. of Coveys	----	17	10
Quail per Covey	----	12.9	12.5

* Excludes a 585-acre lake.
† Excludes a 200-acre lake.

5. Responses of Prairie Chickens to Habitat Manipulation

R. J. Ellis

During the past decade prairie chickens have been restricted mostly to a dozen or so counties in south-central Illinois. Prairie chickens were able to persist in that region because of the extensive acreage of redtop and timothy grown there which furnished nesting cover not found elsewhere in Illinois. These grasses were most useful to prairie chickens when grown for seed, because mowing was not a problem and because a litter of dead grass then accumulated and furnished material needed for nest construction. When the grass fields were pastured or harvested for hay, litter was sparse or absent.

The best nesting cover for prairie chickens has nearly disappeared from Illinois since 1950. According to Illinois Department of Agriculture bulletins, acreages of redtop and timothy harvested for seed have shown a steady decline during the past 14 years, dropping from 70 thousand and 25 thousand acres, respectively, in 1950 to 5 thousand and 9 thousand acres, respectively, in 1964. For the most part the grasslands have been replaced by row crops, which are rarely used by nesting prairie chickens.

If prairie chickens are to be saved in Illinois, it will be necessary to replace nesting cover in at least a few areas. The minimum of grassy cover needed for each remaining flock will be from 300 to 500 acres.

6. Rabbit Management J. A. Bailey, R. J. Siglin

The annual fall census of cottontail rabbits on the Allerton Park 4-H Area was conducted November 20, 1965, with the aid of wildlife management students of the University of Illinois.

The tails of 33 rabbits were dyed yellow with picric acid during early October. The tails of 34 other rabbits were dyed with rhodamine B, a red pigment, during early November. The drive conducted November 20 produced 132 observations of cottontails: 15 white tails, 44 yellow tails, and 73 red tails. Population estimates and confidence limits applicable to early October and to early November can be calculated using the well-known Lincoln-Peterson index method.

It is estimated with 95 percent confidence that there were 99±24 rabbits on the 4-H Area in early October and 61±10 rabbits in early November. If the two marked segments of the population are combined, it can be estimated with 95 percent confidence that there were 76±5 rabbits on the 4-H Area in late October.

The indicated mortality from early October to early November is 38 per 99, or 38 percent. This mortality estimate is supported by another estimate of mortality based upon data concerning only the yellow-tailed rabbits. The drive indicated that one-third of the cottontails had yellow tails. It is therefore estimated that one-third of 61, or 20 yellow-tailed rabbits, were alive in early November. The indicated mortality of yellow-tailed rabbits is therefore 33 less 20 per 33, or 39 percent.

Ten years of data on the cottontail population of the 4-H Area are presented in Table 3.

Table 3. Estimates of cottontail rabbit abundance on the Allerton Park 4-H Area, 1956-65.

Year	Spring Population	Fall Population	
	March	Early October	Early November
1956	---	333	---
1957	47	259	---
1958	31	324	---
1959	132	239	---
1960	56	309	---
1961	161	363	---
1962	24	107	---
1963	61	---	132
1964	58	132	101
1965	---	99	61

This population crashed in 1962 and has never recovered. The 1965 fall population estimates are the lowest on record. The 10-year decline in the number of rabbits present on the 4-H Area has been associated with habitat changes related to plant succession (Monthly Wildlife Research Letter, May, 1965).

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois December, 1965 Vol. 8, No. 12

1. Pheasant Populations and Land Use W. J. Francis, S. L. Etter

The success of hunters on opening day and throughout the 1965 pheasant hunting season was lower than in any of the preceding 5 years (Table 1). The 176 hunters interviewed on opening day in 1965 bagged a cock, on the average, every 8 hours and 24 minutes, whereas 256 hunters interviewed on opening day in 1964 required, on the average, only 1 hour and 59 minutes to bag a cock. The lower hunter success in 1965 appeared to be due to a combination of a lower pheasant population and large acreages of corn which remained unharvested well into the hunting season. Because of the low hunting success on opening day, hunting pressure for the remainder of the season was light. Heavy rains during the last weekend of the hunting season, an otherwise favorable period because most of the corn had been harvested, discouraged even the most persistent hunters.

The age ratio of the 79 cock pheasants shot by hunters and examined by biologists on the Sibley Study Area during the 1965 hunting season was 8.9 juveniles per adult, about the same as in the two preceding seasons. A ratio of 9.0 juveniles per adult was obtained from 140 cocks captured by nightlighting prior to the hunting season. The crippling rate reported by 226 hunters interviewed in 1965 was 14.9 percent; which is similar to rates reported for the 4 preceding years.

Table 1. Pheasant-harvest data obtained by interviewing hunters on the Sibley Study Area during the 1960-65 hunting seasons.

Year	Number of Hunters Interviewed	Number of Cocks Aged By Bursal Examination	Age Ratio of Bagged Cocks (Young per Adult)	Gun-Hours per Bagged Cock	Cocks Crippled and Lost per 100 Downed
1960	496	441	8.3	3.1	31.9
1961	443	402	7.0	2.8	20.9
1962	833	812	11.9	3.3	13.0
1963	468	441	9.2	3.1	24.3
1964	421	425	8.9	2.4	17.2
1965	226	79	8.9	8.0	14.9

2. Manipulation of Pheasant Habitat G. B. Joselyn

The rate of establishment of pheasant nests on seeded roadsides in 1963 (290 nests per 100 acres) was exceeded only by those which occurred in unharvested

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tame hay (322 nests per 100 acres) and harvested tame hay (310 nests per 100 acres) on the 100, 10-acre plots on the Sibley Study Area during 1963; on a per acre basis, all other cover types had lower nest densities (Table 2).

In 1964, seeded roadsides exceeded all other cover types in rate of nest establishment (381 nests per 100 acres). The cover type having the second highest rate was unharvested tame hay, with 281 nests per 100 acres. Next, in descending order, were strip cover, harvested tame hay, small grains, pastures, and non-agricultural areas, with 218, 187, 61, 50, and 20 nests per 100 acres, respectively.

Nest densities on seeded roadsides and in all other cover types decreased in 1965. However, the density of nests on seeded roadsides (260 per 100 acres) still was higher than in any other cover type on the study area; next was harvested tame hay with 140 nests per 100 acres. All remaining cover types, except strip cover (110 nests per 100 acres), had fewer than 100 nests per 100 acres.

Data show that nest densities in four of the six cover types on the 100, 10-acre plots on the study area decreased from 1963 to 1964; only strip cover and small grains had increased densities. Nest density on seeded plots increased from 1963 to 1964. In 1965, nest density on seeded roadsides was considerably below that of the preceding year, and slightly lower than in 1963.

The acceptability of seeded roadsides to nesting hens has been apparent during each of the last 3 years. The low breeding population in 1965 resulted in the decreased nest densities in seeded roadsides and in all other cover types, compared with those of 1963 and 1964.

Table 2. Densities of established pheasant nests on seeded roadside plots and in six other cover types, Sibley Study Area, 1963, 1964, and 1965.

Cover Type	Established Nests per 100 Acres		
	1963	1964	1965
Seeded Roadsides	290	381	260
Unharvested Tame Hay	322	281	96
Strip Cover*	154	218	110
Harvested Tame Hay	310	187	140
Small Grains	35	61	10
Pastures	114	50	20
Nonagricultural Areas	30	20	10

* Includes roadsides, fencerows, waterways, etc.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

Hunters interviewed recently on the Neoga Area reported that a minimum of 38 cocks were bagged at Neoga during the 1965 hunting season, November 13 through December 12. Four additional cocks were crippled but not recovered. Although the kill of cocks in 1965 was less than the kills during the first 3 years of the gene pool experiment, 1960 through 1962, it was equal to the kill in 1963 (Table 3).

Hunting success, expressed as gun-hours expended per cock bagged, in 1965 was comparable to the hunting success in all previous years of the experiment except 1960, the first year (Table 3). The significance of these findings is particularly clear when it is pointed out that no additional stock has been released at Neoga since 1963.

The age ratio among 29 of the cocks bagged in 1965 was 8.7 juveniles per adult; this is similar to the age ratio of 8.9 young per adult for cocks bagged in 1965 on the Sibley Area in the heart of Illinois' best pheasant range. None of the 38 cocks bagged in 1965 were marked (had back tags or leg bands), indicating that all were produced on or in the vicinity of the study area. It is beginning to appear that a low-density but successful pheasant population has been established at Neoga.

Table 3. Statistics of the pheasant harvest at Neoga, Illinois, 1960 through 1965.

	1960	1961	1962	1963	1964	1965
Number of Days in Hunting Season	19½	24½	28½	33½	36½	29½
Date Season Began	Nov. 11	Nov. 18	Nov. 17	Nov. 16	Nov. 14	Nov. 13
Number of Hunters	261	286	353	161	No Date	82
Average Number of Hunters per Day	13	12	12	5		3
Gun-Hours per Cock Bagged	6.1	11.3	9.6	18.8		11.3
Number of Cocks Bagged	111	60	106	37		38
Number of Cocks Crippled and Lost	21	11	14	3		4

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis, R. L. Westemeier

The harvest of quail on the Dale and Forbes areas in 1965 was less than in 1964 (Table 4). On Forbes, 100 quail were harvested in 1965, a decline of 60 percent when compared with a harvest of 253 in 1964. On Dale, 126 birds were harvested in 1965, compared with 230 in 1964, a decline of 45 percent.

Hunting effort on Dale was about the same in 1964 and 1965. On Forbes, however, there were 67 percent fewer hunters in 1965 (113) than in 1964 (341), and the number of gun-hours declined 62 percent from 1964 to 1965. Forbes was closed to upland game hunting during the 6-day deer season in 1965, which could account for some decrease in hunting pressure.

The kills per unit area on both Dale and Forbes have declined each hunting season (1963-1965), except for a slight increase on the Forbes Area in 1964 compared with 1963. The kill per 100 acres on Forbes in 1965, 4.6, was 59 percent smaller than in 1963. On Dale the kill per 100 acres in 1965, 11.4, was 52 percent smaller

Than in 1963. Thus, the kills per unit area have not been maintained and reflect population declines which in turn indicate continuing deterioration of habitat conditions for quail on both areas.

Table 4. Harvest data for quail from the Dale and Forbes areas, 1963-65.

	Dale					Forbes				
	1963	Percent Change	1964	Percent Change	1965	1963	Percent Change	1964	Percent Change	1965
Recorded Kill	175	+31	230	-45	126	170	+49	253	-60	100
Hunting Pressure										
Number of Hunters	139	+76	244	-9	222	103	+231	341	-67	113
Gun-Hours	438	+45	634	+1	642	410	+162	1,074	-62	409
Season (Days)	29.5	+61	47.5	-8	43.5	29.5	+61	47.5	-21	37.5
Hunting Success										
Gun-Hours per Kill	2.5	+12	2.8	+82	5.1	2.4	+79	4.3	-5	4.1
Kill per Hunter	1.3	-31	0.9	-33	0.6	1.7	-59	0.7	+29	0.9
Kill per 100 Acres	23.6	-8	21.7	-47	1[illegible].4	11.3	+2	11.5	-60	4.6

5. <u>Responses of Prairie Chickens to Habitat Manipulation</u> R. J. Ellis

In the spring of 1965, only 26 flocks containing approximately 500 prairie chickens were known to remain in Illinois. This population probably represented less than 1 percent of the number present 30 years ago. The reduction of prairie chicken numbers in Illinois during the present century was brought about by a loss of grasslands required for nesting and brood cover.

Efforts are under way to save prairie chickens from extinction by providing grassland refuges near Bogota. The success of the management efforts can be helped or hindered by land use on private farmlands within the normal cruising range of the flock being managed. Trends in land use at Bogota in 1964 were considered detrimental to prairie chickens. In that year, acreages of row crops and small grains increased and grassland acreages decreased, compared with those in 1963. Fortunately, the unfavorable trends did not continue in 1965 (Table 5). Acreages of grasslands, row crops, and small grains were not noticeably different from those of 1964. Thus, while cover conditions for the prairie chicken were not enhanced, neither were they further impaired.

Table 5. Land use on the Bogota Study Area 1963-65, expressed as percentage of total area.

	1963	1964	1965
Row Crops	59.7	66.2	63.7
Small Grains	13.6	14.0	16.1
Legume Hay	2.4	.9	1.1
Legumes, Idle	1.8	1.2	2.0
Grass Hay	.7	1.5	1.8
Grass, Idle	5.7	3.0	2.9
Grass Pasture	9.3	7.1	6.3
Weeds, Idle	.5	1.0	1.2
Trees and Brush	3.6	2.6	2.2
Other Uses	2.7	2.5	2.7

6. Rabbit Management

J. A. Bailey, R. J. Siglin

An unknown and probably variable proportion of adult female cottontail rabbits produce successive litters after the onset of breeding in March until at least the following August. Many others cease reproductive activity during June or July. The causes of cessation of breeding are not known.

An experiment to test the effect of previous reproductive effort upon the date of cessation of breeding in adult female cottontails was conducted in two half-acre pens during the summer of 1965; only five rabbits completed the experiment.

Reproductive efforts of three animals were restricted by isolating them from male rabbits. One of these rabbits had no chance to breed prior to May 22nd. The other two were isolated from males on March 18th and probably were pregnant at that time. They had no further opportunity to breed prior to May 22nd. The reproductive efforts of two control rabbits were unrestricted throughout the summer as they were always penned with a sexually active male.

On May 22nd all five rabbits were placed in the same pen with a sexually active male. Attempts were made to capture each animal for examination at about 10-day intervals. However, some rabbits were difficult to catch. Captured animals were palpated to determine if they were pregnant and were examined to determine if they were lactating. In mid-August, all rabbits were sacrificed and autopsied.

Results are presented in Table 6. Litter sizes were small throughout the summer, probably due to stresses resulting from the rabbits' confinement in a pen with the sparse cover and frequent human disturbance necessitated by other experiments in the pen. All three cottontails which had restricted breeding in early summer were pregnant in August. No resorptions were evident and litter sizes numbered three or four. One of the two control cottontails which had unrestricted breeding throughout the summer was not pregnant in August and apparently had ceased to breed in late May. The other control cottontail which had unrestricted breeding was pregnant in August, her uterus containing two viable embryos and two resorptions.

The sample sizes are small, but these preliminary results suggest that the amount of previous reproductive effort may be a factor determining cessation of breeding and late-summer reproductive success.

Table 6. Effect of previous reproductive effort on late-summer breeding of penned cottontail rabbits.

Rabbit Number	Treatment	Last-Known Pregnancy	August Litter Size
45	No breeding prior to May 22nd	August	3
7770	One litter probable in April; no more breeding until May 22nd	August	4
7755	One litter probable in April; no more breeding until May 22nd	August	3
7710	Unrestricted breeding throughout summer	May	-
7718	" " " "	August	2*

* Uterus contained two viable embryos and two resorptions.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois January, 1966 Vol. 9, No. 1

1. Pheasant Populations and Land Use

W. J. Francis, S. L. Etter

Fall populations of pheasants on the Sibley Study Area have been estimated on the basis of the proportions of marked birds found in hunters' bags (Lincoln Index) for the years 1962, 1963, and 1964. Populations were estimated at 15,224 in 1962 and at 7,071 in 1964. In 1965, hunting success was so low, and tag returns so few, that no estimate of the size of the fall population could be made by the above method. The margin of error in such estimates is considerable, except for large samples, because only the cock population is directly estimated, and the estimate of the hen population is derived indirectly. Sampling errors in the estimation of the numbers of cocks are compounded by errors in the estimate of the ratio of hens to cocks.

Another index of population size is available in roadside counts of pheasants during the summer. Normally, about 75 percent of the fall population is composed of juveniles (71 - 80 percent in the last 5 years). The preponderance of juveniles suggests that the number of broods and/or chicks seen on standardized transects during July and August will be nearly proportional to the total population the ensuing fall.

A comparison was made between the following four indices of the fall populations for the years 1962-64:

1) Prehunting population calculated from tag returns in hunters' bags.
2) Number of broods observed on 640 miles of road transects.
3) Number of chicks in observed broods (calculated from the number of broods X the average number of chicks in complete broods seen).
4) Total number of birds observed on 640 miles of road transects.

The average of each index for the 2 years 1962 and 1963 (both having fall samples greater than 1,000 birds) was taken as a standard and designated 100. The relative sizes of the populations, in percent of the 1962-63 average, was calculated for each of the above indices (Table 1).

Table 1. Relative sizes of fall populations of pheasants on the Sibley Study Area, as calculated for different indices.

Year	Tag Returns	Number of Broods	Number of Chicks	Total Number of Birds
1962	119	109	113	110
1963	81	91	87	90
1964	55	70	61	71

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The number of chicks on summer road counts (Col. 3) is a good indicator of the fall population size to be expected, although the magnitude of the year-to-year change is less than in the population size calculated from tag returns (Col. 1). The roadside chick index has the additional advantage of providing a population estimate several months in advance of the hunting season.

For the standard transects used on the 36-square-mile Sibley Study Area, the fall population should be computed as the number of broods seen on 640 transect miles X the average size of complete broods X a scale factor, 10.4, which is necessary to express the index in terms of population size. In the summer of 1965, 114 broods were observed, and average brood size was 5.2. The population estimate for fall of 1965 was therefore calculated to be:

$$114 \times 5.2 \times 10.4 = 6,160.$$

This represents a 20.6 percent further decrease in the population decline that has been in progress since the peak year of 1961; the overall decrease is 60 percent in these 4 years.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

In 1963, the seasonal pattern of establishment of pheasant nests was similar for the 21 nests on seeded and the 16 nests on managed control roadside plots (Table 2). On seeded plots, peaks of nest establishment occurred during the weeks of May 6-19 and June 3-16, with approximately 24 percent of all nests being started each of these weeks. By June 3, slightly over 57 percent of all nests of known dates of establishment on seeded plots had been initiated. The peak of nest establishment on control plots occurred during the 2-week period of May 20-June 2, when approximately 38 percent of all nests were initiated. Forty-four percent of all nests of known dates of establishment on the managed control plots were initiated before May 20, and more than 81 percent were started by June 3.

In 1964, also, peaks of nest establishment on seeded plots occurred during the weeks of May 6-19 and June 3-16, but on managed control plots there appeared to be a tendency toward later establishment of nests than in 1963 (Table 2). Although sample sizes were small, the 1965 data from both types of plots show a greater tendency toward early nesting than was apparent the preceding 2 years. The indicated trend toward later nest establishment in 1964 than in 1963 and 1965 may be explained at least partially by the extremely dry spring which occurred throughout east-central Illinois. Between April 23 and June 21, 1964, less than 1.30 inches of rain fell on the study area. Factors attributable to lack of moisture (sparse vegetation, higher ground temperatures, etc.) could have affected the progression of nest establishment.

For a management plan involving seeded roadsides over a large area to be of practical value, data on the progression of nesting on the roadsides are needed. Of greatest importance is the mowing of roadsides, which, from a public relations standpoint, should begin as soon as mowing will have the minimum effect on nesting. In 1963, all nests were either abandoned, destroyed, or hatched by July 25; in 1964, however, 4 of the 14 nests hatched after August 1. Therefore, mowing begin-

ning on July 25, in 1963 would have destroyed no nests, but in 1964 would have destroyed nearly 30 percent of the nests which eventually hatched. In 1965, no nests were established after June 16, and the last nest hatched on July 19; mowing undertaken after July 25 would have destroyed no active nests.

Table 2. Seasonal distribution of the establishment of pheasant nests on seeded and on managed control roadside plots, Sibley Study Area.

Dates	Seeded Plots			Managed Control Plots		
	1963	1964	1965	1963	1964	1965
April 15-May 5	3	1	1	2	0	0
May 6-19	5	4	5	5	0	3
May 20-June 2	4	3	3	6	2	5
June 3-16	5	4	4	1	3	2
June 17-30	3	2	0	2	1	0
July 1-14	0	3	0	0	1	0
July 15-28	1	0	0	0	0	0
Totals	21	17	13	16	7	10

3. Factors Influencing Distribution and Abundance of Pheasants   W. L. Anderson

While the final outcome of the gene pool experiments at Neoga and Bellmont will not be known for several years, it seems probable that none of the strains of pheasants introduced on the two areas possessed genetic makeups, as they existed at times of release, that were compatible with the environmental conditions characteristic of southern Illinois. This conclusion points out the need to find other subspecies and strains of pheasants of the genus *Phasianus* that are potentially capable of maintaining permanent populations outside the established pheasant range in the state.

Several of the numerous forms of *Phasianus*, representing diverse geographical regions and climatic conditions, might be suitable for southern Illinois. Taxonomists recognize 2 species and 34 subspecies of *Phasianus*, which collectively occur in a natural wild state from the southern foothills of the Caucasus Mountains along the Black Sea east across Asia to Korea, Manchuria, Formosa, and Japan. In addition to these forms, it is possible that at least a few of the established populations in North America may also contain pheasants suitable for the southern counties of Illinois.

Accounts in the literature indicate that pheasants were initially established in North America with stock obtained from China (probably from the vicinity of

Shanghai) and western Europe (probably from England). The birds from China were pure Chinese ring-necked pheasants (*P. c. torquatus*). Those from Europe were "English" blacknecks, previously introduced into Europe from the Middle East and of mixed pedigree at the subspecies level. After spending several days at the American Museum, New York City, and at the Smithsonian Institution, Washington, D. C., studying representative specimens collected from wild populations in their native ranges in Asia, it was concluded that the pheasants within the established pheasant range in Illinois are nearly pure *P. c. torquatus*. Other workers have reported that the characteristics of this subspecies dominate throughout the Lake States. It seems certain that *P. c. torquatus* either was released in greater numbers, or it survived best and genetically absorbed other introduced varieties.

As *P. c. torquatus* appears to have been the most successful in those portions of the Lake States that presently constitute the established pheasant range, it is believed that birds from the southern part of the native range of this subspecies offer fair possibilities for establishment in southern Illinois. This subspecies occurs throughout the greater part of China, from about 37° north latitude south to extreme northern Vietnam. It is recommended that pure *P. c. torquatus*, or some closely related subspecies, be obtained from southeastern Asia and be propagated for experimental release in southern Illinois at such time as the world political situation makes acquisition of wild stock feasible.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis, J. A. Eastman

During the past summer (1965) approximately half of the captured quail were marked with back tags, and all captures were marked with leg bands. This marking system was used to determine whether back tags affected quail survival. Custodians at the check stations on the Dale and Forbes areas were asked to collect all bands and back tags from harvested birds. Data indicated that proportionally more banded than back-tagged quail were harvested by hunters (Table 3). Calculated chi-square values approached but did not exceed reference chi-square values at the 0.10 level; however, we considered the sample sizes too small to yield conclusive results. Another possible source of error was that custodians on the Dale Area did not routinely examine harvested quail for markers.

It is always difficult to obtain counts of individual quail when a covey flushes. In addition, bobwhite habits make numbers on back tags doubly difficult to distinguish. Since back tags have been of little value in determining quail movements, we believe that leg bands suffice to mark quail for studies of population dynamics and ecology.

Table 3. Numbers of quail banded, back-tagged and banded, and recovered on the Forbes and Dale areas in 1965.

Area	Number Quail Marked		Number Quail Recovered		
	Banded Only	Back-tagged and Banded	Banded Only	Back-tagged and Banded	Chi-square
Dale	29	26	5	3	0.30
Forbes	43	35	10	3	2.49
Totals	72	61	15	6	2.53

5. Responses of Prairie Chickens to Habitat Manipulation

R. J. Ellis, R. L. Westemeier

Studies of land use on 10 census areas totaling 76,720 acres revealed that the acreage of suitable nesting habitat for prairie chickens in southeastern Illinois continued to decline in 1965 (Table 4). Grass that is neither pastured nor mowed (undisturbed grass) and grass hay mowed after the nesting season, covers of vital importance to nesting prairie chickens, occurred on 6.5 percent of the acreage on the study plots in 1963 but only 2.5 percent in 1965, a decrease from 41.6 acres of good nesting cover per section in 1963 to only 16.5 acres in 1965 (Table 5).

The reduction of undisturbed grass acreage has resulted primarily from the expiration of Federal Conservation Reserve (CR) contracts. In the six counties (Jasper, Wayne, Marion, Clark, Clay, and Effingham) which support the largest numbers of prairie chickens in Illinois, the total number of effective CR contracts decreased from 595 in 1963 to 46 in 1965. In several local areas prairie chickens were believed to be increasing in the early 1960's in response to the CR program. This is no longer the case.

At Bogota, where an effort is currently under way to preserve at least one flock of prairie chickens in Illinois, undisturbed grass and grass hay amounted to 4.4 percent of the 10,240-acre study area in midsummer 1965. This represents 28 acres of nesting cover per section; however, fall plowing in 1965 has further decreased this acreage, and some of the remaining fields of grass offer poor nesting cover because of proximity to woodland, lack of fertility, or other unfavorable conditions.

Since 1960, 254 acres in five separate tracts were acquired for prairie chickens at Bogota, but only 87 acres in the refuge system will provide suitable nesting cover in 1966. Seventy-seven more acres have recently been seeded to redtop, but will not provide nesting cover until 1967. Thus, 164 acres of nesting cover are reasonably assured for 1967 at Bogota. If, however, adequate funds can be raised to purchase 300 additional acres at Bogota, the opportunity will exist for providing a scatter pattern of up to 554 grassland acres in eight different tracts by 1967. This would amount to 34.6 acres of grass per section over an area almost one-half township in size, which several authorities believe is the minimum size necessary to support a self-contained population of prairie chickens. A moderate degree of security would then be assured for the Bogota chickens.

Table 4. Land use on 10 prairie chicken census areas (76,720 acres) in southeastern Illinois, expressed as percentage of total area.

Cover Type	1963	1964	1965
Row Crops	62.5	67.9	70.2
Small Grains	11.7	12.0	13.3
Legume			
Hay	2.3	1.5	1.4
Undisturbed	.9	.6	.7
Grass			
Hay	2.3	1.8	1.1
Undisturbed	4.2	3.3	1.4
Pasture	9.2	6.1	5.7
Weeds	.3	1.3	1.0
Trees and Brush	4.4	3.1	3.0
Other Uses	2.2	2.4	2.3

Table 5. Important grassland acreages per section and numbers of prairie chickens (both sexes) on 10 census areas in southeastern Illinois.

	1963	1964	1965
Undisturbed grassland and grass hay per section	41.6	36.4	16.5
Prairie chickens on booming grounds*	311	288	189
Prairie chickens per section*	2.6	2.4	1.6

* In 1964 and 1965, 12.5 percent and 13.8 percent, respectively, of the total counts were hens.

6. Rabbit Management

J. A. Bailey, R. J. Siglin

Investigators in Missouri have described ulcerative enteritis as a disease in the cottontail rabbit. The disease is believed to be a response to nonspecific stress and can be caused by crowding. Among its symptoms are profuse diarrhea, gastric ulcers, enlarged adrenals, and a small spleen. A disease of this nature, being related to intraspecific stress, could be important in regulating population density.

A condition index, based upon the ratio of body weight to the cube of body length, is often used to evaluate the health and vigor of mammals. During 1965 the relationship between a condition index and the occurrence of symptoms of ulcerative enteritis was investigated. Preliminary results are reported here.

Thirty-one juvenile male cottontails were collected on the South Farm of the University of Illinois between June 23 and October 27, 1965. The animals were obtained by trapping and by hunting at night. The weight and total length of each animal were recorded. Total length was obtained by grasping the animal by the neck and hind legs, extending the animal, and measuring from the tip of the nose to the tip of the hind feet. The animals were frozen for later autopsy. Upon autopsy, the spleen and adrenals of each animal were weighed after removal of associated tissues and blotting on moist paper. A condition index, the ratio of body weight in grams to the cube of total length in decimeters, was calculated for each rabbit. An adrenal-spleen ratio, the average weight of adrenals divided by the weight of the spleen, was also calculated for each animal. The data are summarized in Table 6.

A regression analysis indicated that condition indices were inversely correlated with adrenal-spleen ratios according to the formula $Y = 5.75 - 2.54X$, where Y = the condition index and X = the adrenal-spleen ratio. The coefficient of correlation, -0.49, was significant from zero at the 99 percent level of confidence. These results suggest that condition indices based upon external measurements can be used in evaluating the incidence of stress in cottontail populations.

Table 6. Summary of weights and measurements of 31 juvenile male cottontails collected on the South Farm of the University of Illinois campus, June 23 - October 27, 1965.

	Average	Range	
		Smallest	Largest
Body Weight (grams)	698	273	1,049
Total Length (decimeters)	5.01	3.90	5.65
Condition Index*	5.39	4.60	6.44
Average Weight of Adrenals (mg)	67.4	26.5	117.0
Spleen Weight (mg)	724	159	2,650
Adrenal-spleen ratio†	0.14	0.03	0.35

* Condition index = body weight divided by total length cubed.

† Adrenal-spleen ratio = average weight of adrenals divided by weight of spleen.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois February, 1966 Vol. 9, No. 2

1. Pheasant Populations and Land Use W. J. Francis, S. L. Etter

Cock harvest during the 1965 hunting season, as indicated by returns of back tags and/or leg bands from cocks captured and marked prior to the opening of the hunting season, was lower than in any of the preceding 3 years (Table 1). Only 27 (20 percent) of the 136 cocks tagged during October and early November, 1965, were reported killed during the 1965 hunting season.

The lower kill in 1965 appeared to be due to the lower pheasant population and to large acreages of standing corn during most of the hunting season, rather than to the reduction in length of season and in bag limit. An additional week or two of hunting would have resulted in a slightly higher kill than occurred in 1965 because the corn harvest would have been completed by that time. However the trend toward lower proportional and total kills with lower populations is established by the 1962-64 data (Table 1). During these 3 years the percent of cocks harvested decreased with the declining populations in spite of increases in length of season.

Table 1. Cock harvest in relation to prehunt pheasant density, bag limit, and length of hunting season, Sibley Study Area, 1962-65.

Year	Cocks per Section (Prehunt)	Bag Limit (Cocks)	Length of Season (Days)	Percent of Cocks Harvested ‡
1962	177*	3	29½	48
1963	118*	3	33½	37
1964	80*	3	36½	35
1965	64 †	2	29½	20

* Based upon the ratio of tagged to untagged cocks in the kill.
† Based upon summer brood surveys.
‡ Based upon returns of back tags and/or leg bands.

2. Manipulation of Pheasant Habitat G. B. Joselyn

Seeded roadside plots on the Sibley Study Area vary in slope from 0 to 30 degrees. In each of the last 3 years pheasants established nests throughout this entire range. Chi-square tests performed to determine whether there was a significant tendency for pheasants to nest on slopes of certain degrees or, at the same time, to avoid slopes of other degrees (Table 2) showed no effect of slope on

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Table 2. Effect of slope on rate of establishment of pheasant nests on seeded roadside plots, Sibley Study Area, 1963, 1964, and 1965, as determined by Chi-square tests.

	Degrees of Slope												
	0 - 10				11 - 20				21 - 30				
Year	A*	B	C	D	A	B	C	D	A	B	C	D	X^2
1963	2.4	25.0	11	9.2	5.1	53.1	17	19.6	2.1	21.9	9	8.1	0.8 ns
1964	3.9	35.1	12	11.9	4.5	40.5	17	13.8	2.7	24.3	5	8.3	2.0 ns (Ref. $X^2_{(1)}$0.10 = 4.61)
1965	3.9	30.5	9	7.6	6.5	50.8	12	12.7	2.4	18.8	4	4.7	0.4 ns
													3.2 ns, Total (Ref. $X^2_{(3)}$0.10=6.25)
Total	10.2		32	28.7	16.1		46	46.1	7.2		18	21.1	0.8 ns, Pooled (Ref. $X^2_{(2)}$0.10=4.61)
Average		30.2				48.1				21.7			
													2.4 ns, Interaction (Ref. $X^2_{(2)}$0.10=4.61)

* A = Acreage. B = Percent of total acreage. C = Number of pheasant nests established. D = Expected number of pheasant nests established.

selection of nest sites on the seeded plots. Because a 30-degree slope represents nearly the maximum which can be adequately tilled, it may be concluded from available data that any roadside slope which can be seeded will also be acceptable to nesting pheasants.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

Research concerned with the problem of extending the range of pheasants in Illinois logically falls into three broad categories: (1) experimental releases of different species, subspecies, and strains of Phasianus on areas located south and west of the range now occupied by pheasants; (2) determining environmental differences that exist between range occupied by pheasants and similar appearing areas where pheasants are not successful; and (3) comparing the physical condition, i.e., physiological status, of pheasants from the better range in the state with that of pheasants from marginal and submarginal range. The experimental releases at Neoga and Bellmont have not resulted in the establishment of a stable, self-maintaining population on either area, and new strains of pheasants probably will not be available for release for several years. A reasonably complete study of environmental differences between pheasant range and unoccupied range would require the services of a team of investigators. With the time, money, and manpower available, a study of the physiology of pheasants seems to be the most plausible and rewarding approach at the present time in attempting to extend the range of the pheasant. Therefore, research associated with the experimental releasing of pheasants was de-emphasized in February 1966, and comparative studies of the physiological responses of pheasants from thriving populations and from marginal populations in Illinois will receive primary attention.

The objective of the present emphasis in this study will be to measure physiologic characteristics of pheasants from thriving populations in east-central Illinois and to compare these characteristics with those of pheasants from marginal and submarginal pheasant range for the purpose of disclosing factors preventing extension of this species' range in the state. If a species is not successful in a particular environment, it is because the individuals of that species are not capable of maintaining their normal biological functions under the prevailing environmental conditions. Of paramount importance in the success of a population are the health and vigor of its members, conditions that are normally reflected in the physiological status of animals. Investigations into the physiology of pheasants, a grossly underexplored area of research, will provide clues to the identity of factors suppressing populations within the established range as well as to the factors preventing this species from extending its range into southern and western portions of the state.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis, J. A. Eastman

Studies of the population dynamics of quail in prairie-farmland habitat have been conducted since March 1964 on an area near Alma in Marion County. Eighty-seven percent of this area consists of cultivated land, of which approximately 70 percent is in row crops; habitat conditions are typical of those found throughout much of south-central Illinois. Trends of cultivation, including more row crops, more fall plowing, and removal of brushy cover essential to quail, especially along

fencerows and roadsides, have been detrimental to maintenance of birds on the area. Quail are now limited to small areas primarily along tree - brush drainage systems, which are not frequently disturbed by farm activities.

Estimates of quail populations on Alma from March 1964 to January 1966 are shown in Table 3. The population has declined to a level where the information obtained does not warrant the effort involved. For this reason, and because of expanded management-research programs on the Dale and Forbes study areas, quail-project studies on the Alma Area will be discontinued.

Table 3. Estimates of quail populations, based on censuses conducted on the Alma Area.

Date of Census	Number of Quail	Quail per 100 Acres
1964		
March	100	1.7
November	220	3.7
1965		
January	57	1.0
March	88	1.5
November	125	2.1
1966		
January	23	0.4

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

Redtop (*Agrostis alba*) grass seed has been produced in southern Illinois since about 1875. By 1934, 85 percent of the world production and 95 percent of the U. S. production of redtop seed was in southern Illinois. Redtop has proven to be an important type of nesting cover for prairie chickens in Illinois because harvesting of the hay or seed crop occurs in July, after the critical nesting and brood-rearing period.

Since World War II, major changes have occurred in the land use of southern Illinois, resulting from modern mechanization and application of lime, commercial fertilizer, and pesticides. The decline in prairie chicken numbers has coincided with these changes in land use. Of the total land area in the south-central counties which still support remnant colonies of prairie chickens, 50 - 80 percent is currently occupied by corn and soybean acreage. Undisturbed grass fields for nesting are rare.

Until recent years, the price on redtop seed was unstable. Few farmers now have the proper machinery for harvesting redtop. Also, timing of the harvest is critical if maximum yields of seed are to be obtained; and the harvest period occurs at a time when farmers are busy with other field work.

However, at a major seed company near Bogota, prices received by farmers for redtop seed ranged between 30 and 40 cents per pound in 1965 and 1966. Studies at the University of Illinois experimental farm in Jasper County have shown that average yields of 200 pounds per acre over periods as long as 10 years are possible. The primary treatment was an annual application of nitrogen, 40 pounds per acre. Also, during the experiments several farmers averaged 200 pounds per acre on large fields. As shown in Table 4, high-yielding redtop, at a price of 30 cents per pound, can be as economically sound an investment as row crops or small grains.

If high-yield stands of redtop can be shown to be as desirable for prairie chicken nesting cover as are mediocre stands, known to be used by chickens, the problem of maintaining remnant populations of prairie chickens in Illinois may be partially solved. The results of such research could then be publicized and promoted among farmers still having prairie chickens on their farms. Other species of grass may hold equal promise from the standpoint of both farm economics and prairie chicken ecology.

Table 4. Economic comparison of corn, soybeans, wheat, and redtop on 40 acres each of fertile prairie farmland in southeastern Illinois. Cost estimates are based on advice from U. of I. agronomy staff in Jasper County and from Effingham County farm advisers.

Crop	Gross Income	Annual Production Costs (Percent of Gross Income)	Net Income
Corn	40 a X 100 bu/a X $1.00/bu = $4,000.00	60 percent	$ 1,600.00
Soybeans	40 a X 30 bu/a X $2.35/bu = $2,820.00	50 percent	$ 1,410.00
Wheat	40 a X 40 bu/a X $1.30/bu = $2,080.00	30 percent	$ 1,456.00
Redtop	40 a X 175 lb/a X $0.30/lb = $2,100.00	25 percent	$ 1,575.00

6. Rabbit Management — J. A. Bailey, R. J. Siglin

Data resulting from monthly 10-day trapping periods conducted on the Allerton Park 4-H Area during the fall and winter seasons of the past 2 years (Table 5)

permit evaluation of trap responses of sex and age cohorts in the cottontail population on the area. These data are compiled from the capture records of individual rabbits that were "known-present" during entire trapping periods because they had been captured on the area during a previous period and were recaptured on the area during a later period. This method eliminates bias due to cohort-related rates of immigration and mortality.

Capture frequencies for individual rabbits varied from zero to nine. These data were transformed using $X' = \sqrt{X + \frac{1}{2}}$, and the significance of differences between average capture frequencies was tested using a t - test.

Females were caught more frequently than males in all age-classes. These sex-related differences were significant at the 95 percent level of confidence for known-adults and for the artificial classification of probable-adults, but only at the 90 percent level of confidence for juveniles.

Rabbits in the 4- and 5-month age-class were captured most frequently, being about four to five times more trappable than adults of the same sex. Above this age, capture frequency decreased progressively. Adult males were especially difficult to capture.

Table 5. Trap-responses of sex- and age-classes in the 4-H Area cottontail population; September through February, 1964-65 and 1965-66.

Age-Class*	Sample Size		Average Capture Frequency†		Value of t	Reference Value
	Males	Females	Males	Females		
4-5 Months	30	20	2.0	2.8	1.49	ns‡
6-7 Months	31	23	1.2	1.7	1.35	ns
8-9 Months	16	15	1.1	1.2	0.38	ns
All Juveniles	77	58	1.5	2.0	1.86	$t_{.10}=1.66$
Probable-adults	41	42	0.8	1.4	2.12	$t_{.05}=2.00$
Known-adults	52	88	0.4	0.7	2.17	$t_{.05}=1.98$

* Age determinations are based upon body weights at times of first capture during the study. Probable-adults could not be aged accurately and are either adults or older juveniles. Known-adults had been tagged during a previous year.

† Capture frequencies are the numbers of captures during a trapping period, usually 10 days. Only animals which were known-present during entire trapping periods are considered (see text).

‡ ns = not significant.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | March, 1966 | Vol. 9, No. 3

1. Pheasant Populations and Land Use

W. J. Francis, S. L. Etter

Only 129 pheasants were captured in nightlighting operations on the Sibley Study Area from December 28, 1965, to January 24, 1966, compared with 154 in the winter of 1965 and a high of 413 in the winter of 1963. The most important population statistic obtained from winter-trapped samples is the ratio of juvenile to adult females, which is used with the corresponding ratio obtained from fall-trapped samples to estimate the survival rate of juvenile females relative to that of adult females. To determine whether the population data collected in the last 4 years show significant differences in the survival rates thus calculated, a chi-square test was made of the hypothesis that the survival rate of juvenile females relative to that of adult females is constant. Table 1 compares the age compositions of the observed posthunt samples of hen pheasants with the age compositions of the posthunt samples that would be expected, in each of the 4 years, assuming that the relative survival rate is constant, and equal to that calculated from the age ratios for all 4 years.

The data show no significant difference between observed and expected proportions of juvenile females in the posthunt samples. The important ecological significance of this finding (if substantiated by examination of additional data) is that the relative rates of mortality and survival of juvenile females from fall to early winter are fixed characteristics of the population and do not appear to depend on either environment or population density. In our study area we can expect juvenile hens to survive only half as well as adult hens, i.e., if 100 percent of the adults survive until February, 50 percent of the juveniles will; if only 60 percent of the adults survive (shown by winter censuses to be a fair approximation of the usual situation), then about 30 percent of the juvenile hens also survive. A calculation made prior to the beginning of winter nightlighting indicated that an age ratio of 84 juvenile hens to 100 adult hens would be found in the posthunt sample in 1966; the actual age ratio found was 86 juveniles to 100 adults (Table 1).

Consideration of the magnitude of fall and early-winter losses of females as indicated by these calculations leads to the question of whether hunting could replace some of the natural mortality. A minimum of 26 juvenile hens per square mile, and a probable total of about 60 hens per square mile, were lost between October, 1965, and February, 1966. It would be informative to make a practical test of the proposition that a moderate harvest of hens would be compensated by a reduction in natural mortality.

A secondary implication of the above findings is that winter nightlighting samples, with the population levels attained during the past 4 years, do not provide any information on changes in survival rates between years.

Table 1. Numbers of adults and of juveniles, and corresponding age ratios,* in hen pheasant samples from the Sibley Study Area; calculated survival rates of juveniles relative to adults; age compositions of expected posthunt samples, assuming a constant relative survival rate; and the calculated chi-square value for the difference between observed and expected numbers in the posthunt samples.

	1962-63	1963-64	1964-65	1965-66	Total
Observed Prehunt Sample					
Adult ♀♀	292	219	120	91	722
Juvenile ♀♀	763	375	181	149	1,468
Age Ratio	261	171	151	164	203
Observed Posthunt Sample					
Adult ♀♀	150	68	83	50	351
Juvenile ♀♀	200	66	51	43	360
Age Ratio	133	97	61.5	86	102.5
Survival Rate Relative to Adult ♀♀					
Juvenile ♀♀	.51	.57	.41	.525	.505
Expected Posthunt Sample					
Age Ratio	132	86	76	83	
Adult ♀♀	151	72	76	51	
Juvenile ♀♀	199	62	58	42	
Difference from Observed Posthunt Sample					
Adult ♀♀	1	4	7	1	
Juvenile ♀♀	1	4	7	1	

X^2 (3 df) = 2.026 Not significant (X^2 .90 = 6.25)

* Number of juvenile females per 100 adult females.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

The reduction of hayfield nesting cover for pheasants, which began in 1957, has continued; hayfields occurred on 21 percent of the Sibley Study Area in 1957 but on only 4 percent of the area in 1965. Data strongly suggest that because of this trend in land use, the pheasant population cannot continue to maintain itself at 1960-63 levels unless a suitable alternate nesting cover is provided.

Although there was no substantial difference between the per acre nest densities for the seeded and for the managed control plots in 1963, in 1964 there were 1.6 more nests per acre established on seeded plots than on the managed controls, and 2.2 more nests per acre than on the unmanaged control plots (A and B plots combined, Table 2).

Table 2. Numbers of pheasant nests and of nests per acre on seeded, managed control, and unmanaged control roadside plots, Sibley Study Area, 1963, 1964, and 1965.

	Number of Nests				Number of Nests per Acre			
Year	Seeded	Managed Control	Unmanaged Control-A*	Unmanaged Control-B	Seeded	Managed Control	Unmanaged Control-A	Unmanaged Control-B
1963	44	41	-- †	--	2.9	2.7	--	--
1964	68	38	22	32	3.8	2.2	1.1	2.1
1965	52	33	24	29	2.6	1.6	1.3	1.8
	Percent Change				Percent Change			
1963 to 1964	+35.3	-7.3	--	--	+28.9	-18.5	--	--
1964 to 1965	-23.5	-13.2	+8.2	-9.4	-31.6	-27.3	+15.4	-14.3
1963 to 1965	+15.4	-19.5	--	--	-10.3	-40.7	--	--

* Unmanaged control-A: includes 32, ¼-mile plots randomly selected from that portion of the study area which lies more than 1 mile from the seeded and the managed control plots. Unmanaged control-B: includes 47, 1/8-mile plots which are part of 100, 10-acre plots searched each year to obtain information relative to the nesting ecology of the pheasant. Efforts were made to prevent mowing of managed control plots; no such efforts were made with regard to the unmanaged control plots.

† Unmanaged control plots were not searched in 1963.

In 1965 there was one more nest per acre on seeded plots than on the managed controls, and one more nest per acre than on the unmanaged controls (A and B plots combined). Analysis shows that the number of nests per acre on seeded plots increased 29 percent from 1963 to 1964, but decreased nearly 32 percent from 1964 to 1965; the change from 1963 to 1965 was a decrease of about 10 percent. Density of nests on managed control plots decreased 18.5 percent from 1963 to 1964, 27 percent from 1964 to 1965, and nearly 41 percent from 1963 to 1965. An increase of 15 percent in the nest density along 32, ¼-mile unmanaged control-A plots between 1964 and 1965 was offset by a decrease of slightly more than 14 percent along 47, 1/8-mile unmanaged control-B plots.

Changes in the nest densities on the roadsides are attributed, at least in part, to changes in the pheasant population on the study area. Although not revealing the exact magnitude of population changes, aerial censuses and roadside counts both indicated a major decline in the breeding population from 1963 to 1965.

As determined by aerial census, the prebreeding population on the study area declined from 4,043 in 1963 to 1,684 in 1965, a decrease of over 58 percent (no aerial census was possible in 1964). The aerial counts indicated only general changes in the breeding population because (1) observation conditions were different each time the aerial census was made, (2) it was impossible to distinguish between cock and hen pheasants, and (3) the counts were made 2-3 months ahead of the nesting season (with the magnitude of mortality between the date of the count and the nesting season unknown). The number of adult hens observed during the summer along 640 miles of standardized roadside transects decreased 15 percent from 1963 to 1964, 40 percent from 1964 to 1965, and 49 percent from 1963 to 1965.

Nest density on seeded plots showed an increase of almost 30 percent from 1963 to 1964, while the decrease in the number of adult hens observed on brood runs was slight. However, there was only a 10 percent decrease in the density of nests on seeded plots in 1965 as compared with 1963, in spite of an apparently much larger decrease in the breeding population on the study area.

These data suggest that seeded roadsides may make up an increasingly important segment of the nesting habitat on the study area as the amount of hayfield cover continues to decrease, even during periods of relatively low populations.

3. Factors Influencing Distribution and Abundance of Pheasants   W. L. Anderson

Seven hen pheasants (three juveniles and four adults) were collected in Livingston County during February and were dissected to determine, among other things, weights of muscles and of fat deposits. Muscles weighed occurred in two distinct groups: sternal muscles (*pectoralis*, *supracoracoideus*, and *coracobrachialis anterior*), and leg muscles (all muscles attached to the femur and tibiotarsus). Fat deposits weighed were the fat strip, located on the posteroventral surface of the pectoral muscle, and visceral fat, found in the abdominal cavity, primarily in the greater omentum. The weights of these muscles and fat deposits are summarized in Table 3. The sternal and leg muscles collectively constituted 45-50 percent of the total body weight. Weights of the fat deposits were found to vary considerably, those of the fat strip ranging from 0.4 to 2.1 grams and those of visceral fat from 1.4 to 8.9 grams. As the birds were collected from the better pheasant range in the state, and as weather conditions during the past winter were comparatively mild, it is thought that these weights of muscles and of fat deposits are representative of healthy hen pheasants during the winter months.

Table 3. Mean weights of muscles and of fat deposits of seven hen pheasants (three juveniles and four adults) collected in Livingston County, Illinois, during February 1966.

	Weight (grams)		Percent of Entire Carcass	
	Mean	Range	Mean	Range
Entire Carcass	906	775-1,002	----	----
Muscles				
Sternal	257	241-278	28.5	26.6-31.1
Leg	165	134-185	18.3	17.3-19.6
Fat Deposits				
Fat Strip	1.1	0.4-2.1	0.12	0.05-0.23
Visceral Fat	4.7	1.4-8.9	0.51	0.18-0.96

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, J. A. Eastman

Quail can be sexed and aged in the fall by plumage characteristics. Sex is determined by dimorphism of the head plumage. Young-of-the-year (juveniles) are distinguished from adults by the appearance of the seventh primary covert and by the progress of molt of the primary flight feathers.

Harvested quail on the Dale and Forbes areas were sexed by park custodians, who removed one wing from each bird at the check stations. Wings were then aged by project biologists. Sex and age data for harvested quail on the two areas are presented in Table 4.

Juvenile quail comprised over 80 percent of the harvests for all years (1963-65) on both study areas. Although fall populations on the two areas were considerably lower in 1965 than in 1964 and harvests reflected a similar trend, the percentage of juveniles in the harvest increased from 1964 to 1965 on both areas. Poor survival of adults in the summer and fall of 1965, rather than reproductive success, was thought to have influenced the increase in percentage of juveniles in the bag in 1965.

Disproportional sex ratios are common among bobwhite juveniles and adults. Most published studies report males outnumbering females. On the Forbes Area, males have consistently outnumbered females in the adult samples. Among the juvenile segments of the kills, however, sex ratios have favored females. Similar trends in sex ratios were noted in kills on the Dale Area, with the exception of 1963. In that year, adult sex ratios favored females, while juvenile sex ratios favored males.

Studies generally agree that mortality of females during breeding season accounts for the unbalanced sex ratio favoring males among adults. The consistent unbalanced sex ratio favoring females among juveniles (for 3 years on the Forbes Area and for 2 of 3 years on the Dale Area) may indicate that the sex ratio favors females at hatch, or that juvenile females are more vulnerable to hunting pressure than juvenile males. The latter premise seems unlikely.

Table 4. Sex and age ratios among quail harvested from two Illinois areas, 1963-65.

Area	Adults ♂♂	Adults ♀♀	Adults Percent Males	Juveniles ♂♂	Juveniles ♀♀	Juveniles Percent Males	All Quail Percent Juveniles
Forbes							
1963	12	11	52.2	63	80	44.0	86.1
1964	29	20	59.2	87	110	44.2	80.1
1965	8	7	53.3	38	46	45.2	84.8
Totals	49	38	56.3	188	236	44.3	83.0
Dale							
1963	12	16	42.8	82	52	61.2	82.7
1964	15	12	55.6	80	95	45.7	86.6
1965	10	2	83.3	46	52	46.9	89.1
Totals	37	30	55.2	208	199	51.1	85.9

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

Preliminary booming ground surveys of prairie chickens at Bogota in 1966 indicate a breeding population essentially unchanged since the late-winter period of 1965 (Table 5). The maximum count during the 1965 booming season was 53 birds (on April 9), which included 47 cocks and 6 hens. The general pattern observed at Bogota in past years during individual booming seasons has been a gradual rise and decline in the number of chickens present on booming grounds, the peak occurring during the first 10 days of April.

The count of 56 chickens in early March 1966 included a flock of 12 birds flying, and 4 cocks on a booming ground outside the east edge of the 16 square miles which have been censused in past years. Prairie chickens are also reported to be present within 4 miles southeast and 3 miles northwest of the Bogota Study Area. In the spring of 1966, effort will be made to learn the status of prairie chickens near, as well as on, the study area of previous years.

Table 5. Numbers of prairie chickens (mostly cocks) on booming grounds, Bogota Study Area, 1963-66.

Period	1963	1964	1965	1966
February				
1-10		44		42
11-20		50	30	
21-28		55,62		43,40,37
March				
1-10		43	32,24,43	37,56
11-20		50,61	38,39	38
21-31	79	89,58,58	37	
April				
1-10	74,89	64,74	43,32,37,53	
11-20	61,56	73,57	35	
21-30	42	41	29	
May				
1-10	56	37,37	15,17	
11-20	39	35		
21-31	34	29,24		
June				
1-10	27,10			
11-20	22			
21-30	6			
Peak Count	89	74*	53	†

* The count of 89 in 1964 was believed to involve duplications.
† Comparable data not yet available.

6. Rabbit Management — J. A. Bailey, R. J. Siglin

Hunter-success cards have been collected on the Sam Dale State Park in Wayne County and on the Stephen A. Forbes State Park in Marion County during the past three hunting seasons. The success of hunters who visited these two areas specifically to hunt cottontail rabbits is presented in Table 6. (Data for hunters who visited the areas to hunt quail only, or both rabbits and quail, are not included.)

The Dale Area experienced a large increase in hunting pressure and in number of rabbits harvested during the 1965-66 hunting season. Hunter success, however, increased only slightly from 1964-65 and was still below hunter success experienced in 1963-64.

In contrast, hunting pressure and number of rabbits harvested declined on the Forbes Area during 1965-66. Hunter success has varied little on this area during the past three seasons and has usually been lower than hunter success on the Dale Area.

Eye lenses were collected from samples of the harvested rabbits. The age-distributions of these samples are presented in Table 7. Over the past 3 years the proportions of juveniles in the Forbes Area samples have never varied significantly from 83 percent, considered to be normal for cottontail rabbits. The proportion of juveniles in the Dale Area sample of 1965-66 was below normal.

The average date of birth for juvenile rabbits collected on the Dale Area has been within the first week of May during all 3 years. The average date of birth for juvenile rabbits on the Forbes Area during 1965 was unusually early.

Table 6. Success of hunters who visited two Illinois areas specifically to hunt cottontail rabbits, 1963-64 to 1965-66.

	Sam Dale State Park			Stephen A. Forbes State Park		
	63-64	64-65	65-66	63-64	64-65	65-66
Hunter-trips	43	85	244	79	214	145
Hours Hunted	125	344	836	331	731	513
Rabbits Harvested	133	151	488	129	363	208
Rabbits per Trip	3.1	1.8	2.0	1.6	1.7	1.4
Rabbits per Hour	1.1	0.4	0.6	0.4	0.5	0.4

Table 7. Age-distribution of cottontail rabbits harvested from two Illinois areas, 1963-64 to 1965-66.

	Sam Dale State Park			Stephen A. Forbes State Park		
	63-64	64-65	65-66	63-64	64-65	65-66
Number of Rabbits Aged	140	70	129	114	71	135
Percent Juveniles*	81±7	76±10	68±8	78±8	87±8	79±7
Average Birth-date, Juveniles*	May 7 ±19 days	May 3 ±13 days	May 2 ±12 days	May 28 ±23 days	June 1 ±12 days	April 21 ±9 days

* Plus or minus two standard errors.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois April, 1966 Vol. 9, No. 4

1. Pheasant Populations and Land Use W. J. Francis, S. L. Etter

The majority of marked pheasants on the Sibley Study Area moved less than ¼ mile between times of successive observations during the winter of 1964-65 (Table 1). Of the 716 movements recorded from the end of the hunting season in 1964 (December 20) until the onset of establishment of territory in early April, 1965, only 176 (24.5 percent) exceeded ¼ mile. This pattern of relatively limited movement is further evidenced by the fact that maximum distances moved between times of successive observations exceeded 1 mile for only 19 of 76 individual pheasants observed five or more times each during this period (Table 2).

Although more precise data are necessary to evaluate the relationships between movements and food and cover requirements, the data presented above suggest that suitable wintering areas for pheasants must provide, within an area of ¼ section or less, for all requirements of the birds. This factor should be taken into account in any attempts to manage or improve winter habitat.

Table 1. Number of observations of marked pheasants moving specified distances during periods between successive observations, winter, 1964-65, Sibley Study Area.

	Number of Observations for Each Category of Miles Moved								Total Number of Observations	Total Number of Individuals
	0-¼	¼-½	½-1	1-2	2-3	3-4	4-5	5+		
Adult ♂♂	9	2	2						13	5
Adult ♀♀	327	57	38	11	8	3	3	1	448	116
Juvenile ♂♂	76	5	8	2	1		1		93	19
Juvenile ♀♀	128	17	9	2	4	1		1	162	35
Total	540	81	57	15	13	4	4	2	716	175

Table 2. Maximum distances moved between times of successive observations for marked pheasants observed five or more times each during winter, 1964-65, Sibley Study Area.

	Number of Pheasants for Each Category of Miles Moved					
	0-$\frac{1}{2}$	$\frac{1}{2}$-1	1-1$\frac{1}{2}$	1$\frac{1}{2}$-2	2-2$\frac{1}{2}$	Total
Adult ♂♂	2	1				3
Adult ♀♀	19	15	5	5	2	46
Juvenile ♂♂	6	3	3			12
Juvenile ♀♀	6	5	2	2		15
Total	33	24	10	7	2	76

2. Manipulation of Pheasant Habitat

G. B. Joselyn

The public's acceptance of grass - legume seedings along roadsides for pheasant nesting habitat over extensive areas will be dependent largely on the quality of those seedings. Experience on the Sibley Study Area since 1963 has shown that farmers have few objections to seeded roadsides provided the seeded areas are kept relatively free of weeds.

Foxtail (Setaria spp.), of the grass weeds, and curled dock (Rumex crispus) and goat's beard (Tragopogon sp.), among the broadleaf weeds, created some problems on seeded roadsides the first year of their existence (1963). Experimental seedings since 1963 have shown that improved tillage and seeding techniques offer the best hope for controlling weeds. However, regardless of the techniques employed, weeds may always be present on newly seeded roadsides to some extent, which may call for some chemical means of control.

In August, 1965, new seedings totaling approximately 1$\frac{1}{4}$ miles in length were made along roadsides at three locations. The seedings at each of the three locations were divided into four randomly selected segments of equal length for the study of experimental weed-control measures during the spring of 1966; the effectiveness of a pre-emergent grass-weed control chemical, Ramrod, and of a postemergent broadleaf-weed control chemical, 4-(2,4-DB) will be tested. The following applications of chemicals on each of the three locations will be made: Ramrod only; 4-(2,4-DB) only; 4-(2,4-DB) and Ramrod; and control (no treatment).

Ramrod was applied in granular form on April 15. The broadleaf-weed control chemical will be applied during the first week of May; this chemical is supposed to eliminate broadleaf weeds in established legume seedings without harming the seeded legumes (alfalfa and red clover).

Vegetative analysis will be undertaken at various intervals throughout the summer to determine the relative frequency of occurrence of weeds among the treated and control segments.

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson

Hen pheasants collected from the better pheasant range in the state during April 1966 were 18 percent heavier, on the average, than hens collected from the same area last February (Table 3). Most of the increase in weight was attributable to increased depositions of fat; the fat strip and visceral fat averaged 327 and 428 percent heavier, respectively, in the April-collected hens than in the February-collected birds. The increase in body weight was accompanied by pronounced enlargements of the reproductive organs, the ovary increasing in weight nearly 10-fold and the oviduct nearly 14-fold (Table 3). It is presumed that the increases in body weight from winter to the prenesting period are indicative of a general increase in reserves of basic metabolic fuels preparatory to the stresses of the approaching nesting season. The data presented in Table 3 tentatively suggest that hens in the better pheasant range are entering the 1966 nesting season in good physical condition.

Table 3. Weights, in grams, of the carcass, and of various parts, of hen pheasants collected in Livingston County, Illinois, during the winter period and the prenesting period of 1966. Sample sizes are in parentheses.

	Winter Period Feb. 1966		Prenesting Period April 1966		Percent Change from Winter to Prenesting Period
	Mean	Range	Mean	Range	
Entire Carcass	906(7)	775-1,002	1,069(6)	956-1,295	+18
Muscles					
Sternal	257(7)	241-278	266(5)	243-296	+4
Leg	165(7)	134-185	178(5)	162-198	+8
Fat Deposits					
Fat Strip	1.1(7)	0.4-2.1	4.7(6)	2.4-7.8	+327
Visceral Fat	4.7(6)	1.4-8.9	24.8(6)	10.4-36.5	+428
Reproductive Organs					
Ovary	0.2(7)	0.1-0.3	2.1(6)	0.5-7.0	+950
Oviduct	0.4(7)	0.1-0.7	5.8(6)	1.0-14.7	+1,350

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, J. A. Eastman

Various methods have been used to determine percentages of quail harvested on the Dale and Forbes areas since 1963. These calculations were made by comparing (1) prehunt estimates with recorded kills; (2) prehunt estimates with posthunt estimates; (3) posthunt estimates plus kills with kills.

From all indications, 42-49 percent of the 1963 prehunt population on the Forbes Area was harvested (Table 4). In 1964, estimates of harvest varied from 45 to 94 percent on Forbes. We believe, however, that approximately 50 percent of the prehunt population was removed by hunting. In 1965, the most realistic estimate of harvest was 40 percent of the prehunt population on Forbes -- though estimates ranged from 49 to 74 percent.

Estimates of percentage harvests on the Dale Area ranged from 59 to 80 percent for the 3 years (Table 4). Surprisingly, the most realistic harvest estimates for the 3 years on the Dale Area were consistently about 60 percent.

Harvest levels for bobwhites from various areas throughout their range are not available in the literature. It is generally assumed by biologists that 40 percent of the fall quail crop can be harvested without adversely affecting the welfare of the population. On the Dale and Forbes areas, harvest levels have equaled or exceeded 40 percent for all years (1963-65). The removal of 50 percent of the prehunt population on Forbes in 1964 may have reduced the population below carrying capacity.

The welfare of quail is, obviously, dependent upon the quality of available habitat. Many factors affect habitat conditions, causing them to vary from area to area. Therefore, the degree of harvest that quail populations will tolerate is also variable. Harvest management programs should be directly related to habitat conditions, i.e., geared to the harvest levels that would not endanger the welfare of the population. These conditional criteria have not been recognized in the management programs for Forbes and Dale.

Table 4. Estimated percentage harvests of quail on the Forbes and Dale areas, 1963-65.

Area and Year	Recorded Kill	Basis of Estimate: Prehunt Census vs. Kill	Prehunt Census vs. Posthunt Census	Posthunt Census + Kill vs. Kill
Forbes				
1963	170	49	42	46
1964	253	94	45	63
1965	100	49	74	65
Dale				
1963	175	59	69	67
1964	230	80	59	66
1965	126	62	70	67

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

Land acquisition at Bogota for prairie chicken nesting sanctuaries has recently proceeded at an accelerated and encouraging rate. The generosity and hard work of many conservation-minded individuals have made it possible to purchase a total of 434 acres in seven separate tracts for prairie chicken management (Table 5).

Of the 237 acres acquired by the Prairie Chicken Foundation of Illinois, 87 acres of established nesting cover are playing a key role in maintaining the Bogota population. During the 1966 booming season, 15 individual hens were seen by observers in blinds on each of two mornings on a booming ground on the 77-acre Yeatter Sanctuary. On another occasion, 17 individual hens were believed to have visited this booming ground. This is a greater number of hens on one booming ground than the sum of hens recorded on all booming grounds during any of the previous 3 years on the Bogota Study Area. Apparently, the stage is set for a high density of prairie chicken nests on the Yeatter Sanctuary in 1966.

Since its formation in the fall of 1965 the Prairie Grouse Committee, Illinois Chapter-The Nature Conservancy has acquired 197 acres of prairie farmland. Two tracts totaling 157 acres have been seeded to grass and it is hoped that the new 40-acre tract will be seeded this spring; all three tracts should provide nesting cover by 1967.

On private farmland, only 26 acres of good nesting cover were available for leasing by the Illinois Department of Conservation in 1966 (Table 5). In addition, about 189 acres of poor quality nesting cover on private farmland are available to nesting prairie chickens; some of this acreage has also been leased. One encouraging fact is that three local farmers have recently seeded a total of about 30 acres of redtop and 20 acres of timothy, which they plan to lease to the Department of Conservation when the nesting cover is established.

A total of about 700 acres of nesting cover should be available to the Bogota chickens by 1968. Also by that time, it is hoped that a management program is well under way toward saving a flock in at least one other area. The flock near Farina, which overlaps into Marion, Fayette, and Effingham counties, appears to offer the second-best chance for success.

Table 5. Status of the prairie chicken refuge system and of nesting cover in local ownership on the Bogota Area, April 20, 1966. Dates in parentheses indicate year when acreage should provide nesting cover.

	Number of Acres			
Ownership	Established Nesting Cover (1966)	Newly Seeded (1967)	To Be Seeded (1968)	Totals
PCFI*	87	60	90	237
PGC†	0	157	40	197
Local Farmers				
Good nesting cover	26‡	50		76
Poor nesting cover	189‡			189
Totals	302	267	130	699

* Prairie Chicken Foundation of Illinois.
† Prairie Grouse Committee, Illinois Chapter-The Nature Conservancy.
‡ All or in part leased by the Illinois Department of Conservation.

6. Rabbit Management

J. A. Bailey, R. J. Siglin

The annual spring census of cottontail rabbits on the Allerton Park 4-H Area was conducted March 19, 1966, with the help of students of the University of Illinois. The tails of 25 rabbits were dyed black during trapping operations in February and early March. In addition, some yellow-tailed animals -- from 33 rabbits marked in October, 1965 -- were present in the population.

There were 210 observations of rabbits during the census: 98 of white-tailed animals, 27 of yellow-tailed animals, and 85 of black-tailed animals. Using these data, it is estimated with 95 percent confidence that 62 ± 13 rabbits were present on the 120-acre 4-H Area during early March, 1966. (Population estimate and confidence limits are based upon the Lincoln-Peterson index.) Ten years' data for the 4-H Area cottontail population are presented in Table 6.

In past years, estimates of winter mortality for this cottontail population have been based upon differences between October and spring population estimates. However, trapping during November and December, 1965, indicated that many rabbits immigrated onto the 4-H Area during these months, coincident with a later-than-usual harvest of corn. Consequently, the only appropriate estimate of winter mortality for the 1965-66 season must be based upon survival of yellow-tailed rabbits marked during October. The census indicated that 13 percent (27 of 210) of the spring population of 62 rabbits had yellow tails. This indicates a survival of 8 out of 33 animals marked during October, producing a mortality estimate of 76 percent.

Table 6. Estimates of cottontail rabbit abundance on the Allerton Park 4-H Area, 1956-66.

Year	Spring Population	Fall Population	
	March	Early October	Early November
1956	---	333	---
1957	47	259	---
1958	31	324	---
1959	132	239	---
1960	56	309	---
1961	161	363	---
1962	24	107	---
1963	61	---	132
1964	58	132	101
1965	---	99	61
1966	62		

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

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1. Pheasant Populations and Land Use — W. J. Francis, S. L. Etter

Roadside observations of the behavior of pheasants on the Sibley Study Area indicate that a high level of breeding has been maintained during the 4 weeks from April 23 to May 20, 1966. During the entire period the percent of all groups of pheasants observed that were bisexual groups (harems) has remained at about 40 percent. The absence of any one week which could be called the peak of breeding represents a departure from the behavior patterns of the preceding 4 years. In each of the years from 1962 to 1965 a single week in which nearly 50 percent of all groups were harems was well defined.

To what extent the abnormally low temperatures during the week of May 7-13 may have affected the reproductive cycle is unknown. It appears, however, that the aberrant breeding behavior in 1966 could be the result of the higher sex ratio (approximately 40 cocks per 100 hens compared with 15-22 cocks per 100 hens in 1962-65). It is possible that the greater proportion of cocks in the population and a consequently higher degree of association of hens with these cocks could have masked the fluctuations in grouping behavior which were apparent in the preceding years.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

It is important that vegetative characteristics on seeded roadsides be measured from year to year to determine (1) factors which make certain roadsides more attractive than others to nesting pheasants, and (2) relationships between nest density and changes in vegetative composition. One of the most important factors in determining the practicality of managing roadsides for pheasant nesting cover is determining when the seedings become attractive to pheasants and how long this attraction is maintained.

Vegetative analysis of seeded roadsides was undertaken in 1963, 1964, and 1965, when the seedings were 1, 2, and 3 years of age. Vegetation was sampled with a 1/12-square-meter quadrat at four randomly selected locations on each $\frac{1}{4}$-mile seeded plot and at two randomly selected locations on each 1/8-mile plot. Percent of total top cover contributed by each species present was estimated and frequency of occurrence of the various seeded and nonseeded plant species was obtained within each quadrat.

With the exception of brome (*Bromus* spp.), occurrence of all species decreased during the second and third years after seeding (Table 1). By the third year brome had increased to more than double its frequency of the first year. Alfalfa (*Medicago sativa*) decreased more between the first and second years than between the second and third. Three years after the seedings were established all species seeded, except brome and alfalfa, had been reduced to almost insignificant levels

of occurrence. It is reasonable to expect that brome will continue to increase while other species continue to decrease.

Should pheasants prefer to establish nests only in a mixture of grasses and legumes (as originally seeded), the increasing preponderance of brome on the roadsides could make these areas less attractive to nesting pheasants. From a management standpoint, it will be important to know at what stage in the vegetative succession of a seeded roadside it begins to lose its attractiveness as pheasant nesting cover. However, should it be shown that pheasants are as attracted to seedings consisting of brome only, or a brome-alfalfa mixture, as they are to the multispecies mixture, then the cost and effort of establishing seedings would be significantly reduced. It is hoped that the analysis of plant species preference in selection of pheasant nest sites will shed some light on this question.

Table 1. Changes of vegetation, with age, on seeded roadsides, Sibley Study Area. Figures represent the percent of total quadrats taken in which the species occurred.

Species	First Year	Second Year	Third Year
Alfalfa	78	69	66
Red Clover	69	9	3
Brome	40	71	86
Orchard Grass	46	20	12
Timothy	15	9	7
Other*	36	35	22

* Includes all grasses and broad-leaved plants not seeded.

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson

During May 1966, a total of 39 cock pheasants were located on the Neoga release area by observation and audio-triangulation. In previous years, 1960 through 1965, the number of cocks located at Neoga was 79, 88, 121, 94, 16, and 28, respectively. The indicated increase in the population of cocks from May 1965 to the same month in 1966 probably is not as great as the data imply. Nine of the 39 cocks found in 1966 were located to the west and to the south of the area censused in 1965. Nevertheless, it is apparent that the population did at least maintain itself, and might have increased slightly, from May 1965 to May 1966. These findings offer continued encouragement that a low-density population of pheasants is becoming established in the vicinity of Neoga.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis

For the past 3 years (1964-66), censuses using bird dogs to locate quail have been made on the Forbes and Dale areas to obtain estimates of the populations in late December (posthunt) and early March (prebreeding). Results of these censuses are shown in Table 2.

The posthunt and the prebreeding estimates of quail populations on Forbes have

exhibited progressive declines for 3 consecutive years. The 1966 prebreeding estimate was less than 2 birds per 100 acres, a low population density.

Estimates of the posthunt populations on the Dale Area have varied for the past 3 years, but estimates of the prebreeding populations have been consistent during the same period. The late-winter carrying capacity for quail on the Dale Area appears to be approximately 4 quail per 100 acres.

The size of the posthunt population for a particular year does not appear to determine the size of the prebreeding population. On both areas the greatest percent loss from January to March occurred in 1965. The prebreeding populations on Dale and on Forbes were 64 percent and 50 percent smaller, respectively, than the posthunt populations. On Dale, there was a 48 percent loss from January to March in 1964; on Forbes in 1964 the loss was 42 percent. In 1966, the two areas exhibited similar losses from January to March, with the prebreeding populations 20 and 21 percent smaller than the posthunt populations on Dale and Forbes, respectively. The magnitude of these losses (January-March) was undoubtedly influenced by weather conditions.

Table 2. Estimates (by censuses with dogs) of posthunt and of prebreeding quail populations on two Illinois areas, for a 3-year period.

	Number of Quail			Quail per 100 Acres		
	1964	1965	1966	1964	1965	1966
Forbes						
Posthunt	202	147	53	9.2	6.7	2.4
Prebreeding	117	74	42	5.3	3.4	1.9
Dale						
Posthunt	88	116	61	8.3	10.5	5.5
Prebreeding	46	42	49	4.3	3.8	4.4

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier

The spring of 1966 was the fourth during which censuses of booming prairie chickens were made on 10 selected areas in south-central Illinois. Three or more counts were made on most areas and the count which included the largest number of cocks was taken as the census figure. All counts were made during the first hour of daylight.

No prairie chickens were found in the spring of 1966 on 3 of the 10 census areas, and less than 10 booming cocks could be found on each of 4 other census areas (Table 3). A total of only 104 cocks were counted on the 10 census areas, a decline of 30 percent between 1965 and 1966. Losses between 1964 and 1965 (based on totals of cocks only), and between 1963 and 1964 (based on totals of both cocks and hens) were 35 percent and 16 percent, respectively. The data indicate that prairie chickens are ultimately doomed to extinction in all areas of the state where no substantial measures are taken to provide them with nesting cover.

The process of extinction was especially evident at Hookdale in Bond County in 1966, where five cocks were seen on a booming ground during a late March count, but on two mornings in mid-April three to five solitary cocks were up to 1 mile or more apart and exhibited unstable territorial behavior. At Hunt in Jasper County in 1966, no chickens were seen on the 4-square-mile area that was first censused by Dr. Ralph E. Yeatter in 1936 (Table 3), but one cock, with two hens, was seen about $\frac{1}{4}$ mile from the east edge of this area.

There is good reason to believe that the 13 percent decline shown for Bogota in 1966 (Table 3) is not the true situation. The peak count of 47 cocks in 1965 was made during a period when counts were declining on one booming ground and increasing on another ground, and duplications in the high count probably occurred. The average for 12 counts made between mid-February and late April, 1965, was 34.0 cocks, but during the same period in 1966, the average for 20 counts was 37.8 cocks. Also, the number of cocks on the booming grounds showed a greater degree of stability in 1966 than in 1965. These data cast strong doubt that a population decline actually occurred at Bogota between 1965 and 1966. Hopefully, this is the first indication that management activities at Bogota are becoming effective in the preservation of prairie chickens there.

Table 3. High counts of prairie chickens on booming grounds on 10 census areas in south-central Illinois, 1963-66. Numbers in parentheses indicate additional birds found subsequent to 1963 within 1 mile of, but not in, the 1963 census areas.

Census Area	Cocks & Hens* 1963	Cocks Only 1964	Cocks Only 1965	Cocks Only 1966	Percent Change 1965-66
Jasper Co.					
Bogota	89	65	47	41	-13
West Liberty	10	5	7	5	-29
Hunt	4	10	3	0	-100
		(7)	(6)	(1)	
Wayne Co.					
Mt. Erie	45	48	31	18	-42
Cisne	23	7	0	6	+600
		(17)	(15)	(3)	
Marion Co.					
Farina	53	27	29	23	-21
		(6)	(11)	(10)	
Clark Co.					
Martinsville	29	23	14	6	-57
		(6)	(3)	(2)	
Bond Co.					
Hookdale	18	16	13	5	-62
Effingham Co.					
Dieterich	14	10	2	0	-100
Clay Co.					
Xenia	25	16	2	0	-100
All Areas	310	227	148	104	-30
		(36)	(35)	(16)	

* Mostly cocks.

6. Rabbit Management J. A. Bailey, R. J. Siglin

In an earlier monthly report (July 1965) the results of a study of summer cover preferences by penned cottontail rabbits was reported. This report deals with a study of winter cover preferences. A Latin-square design was used, as described for the summer period. Four types of cover were provided: slats, forbs, conifers, and brush piles.

The slat plots consisted of 4-foot-square pieces of snow fence suspended horizontally 1 foot above the ground, with unmowed wild forbs growing underneath. Forb plots consisted of a variety of unmowed wild forbs in 4-foot-square plots. The conifer plots were single Pfitzer junipers (Juniperus chinensis pfitzeriana) which covered a circle about 4 feet in diameter. Brush piles were constructed of 10 wooden posts, each 8' X 4" X 4". The posts were laid parallel to one another, in tiers, to form an 8-foot-long pile with triangular-shaped ends. A rabbit could crawl into the 4- X 4-inch spaces between the posts. Each pile of posts was covered with cuttings from apple trees. Except for a narrow strip along the enclosing fence, the area outside the plots was mowed in the fall.

Four to five rabbits were kept in the pen and periodic observations were made during December, January, and February. The following number of rabbit observations were made in each cover type: slats-52, forbs-19, conifers-43, and brush piles-7. All the above values, except that for conifers, were significantly different from an expected value of 32.5 observations, using the Chi-square test.

Cover use varied with time (Table 4) and the use of each type is summarized as follows:

Outside. -- Although the area outside the cover plots was not considered one of the test plots, rabbit-observations in this area are worth mentioning. In general, rabbit use of cover outside the plots was correlated with temperature. December was the warmest month and 55 percent of the rabbit-observations occurred outside the plots. The number of rabbits observed outside the cover plots declined drastically with the onset of colder weather in January and February. A warm spell during the second week of February was correlated with five observations of rabbits outside the plots.

Forbs. -- Of all the cover types, forbs provided the least concealment. Forbs were used as much or more than any other cover during December. They received continued use in January, but little use in February. This decline in use was probably due to a progressive deterioration of cover in the forb plots.

Slats. -- Use of slats in December equalled that of forbs. However, the slat plots received their greatest use in January, when use of the area outside the plots decreased and the cover-value of forb plots began to decline. Use of slats declined in February presumably because of a deterioration of the forbs under the slats. Compared with the forb plots, the vegetation under the slat plots held up for a longer period of time, and the slats themselves provided additional overhead concealment for the rabbits.

Conifers. -- Conifers were apparently preferred only after the cover in the

forb and slat plots had deteriorated to the extent that little concealment was provided. The use of conifers may have also been related to temperature, but the data are not clear. Conifers provided good concealment, both overhead and to the side.

Brush. -- Of all the cover types, brush piles provided the most protection but received the least use. In December a new rabbit was released in the pen and spent the first 2 days in one of the brush piles. In February three observations of rabbits in brush piles were associated with a 4-inch snowfall. This was the only appreciable snowfall of the winter. Two more observations were made on the edge of brush piles, but the rabbits were feeding heavily on apple cuttings at the time.

The results of the study are surprising in that the two cover types affording the most concealment (conifers and brush) were not preferred until the month of February, and the area affording the least concealment (outside the plots) was preferred during December. The generally accepted idea seems to be that rabbits prefer to use the heaviest cover available. These data indicate that a moderate cover density is preferred, except under severe climatic conditions.

Table 4. Percent of rabbit observations in each cover type, December, January, and February, 1965-66.

Cover Type	December	January	February
Outside	55.2	10.4	10.3
Forbs	15.5	18.8	1.7
Slats	15.5	50.0	32.8
Conifers	10.4	20.8	46.6
Brush	3.4	0.0	8.6

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson, Editor

Urbana, Illinois June, 1966 Vol. 9, No. 6

1. Pheasant Populations and Land Use W. J. Francis, S. L. Etter

An analysis was made of the accuracy obtainable in searching 100 ten-acre plots on the Sibley Study Area for pheasant nests. The amount of hay (an important pheasant nesting cover) on the sample plots in 1965 was so low that it was not believed to be an adequate sample, so the analysis was carried out for the data obtained in 1964 (Job Completion Report W-66-R-5, Job No. 2, July 15, 1965).

The Poisson distribution is a fair approximation of the distribution of organisms randomly spaced in a medium. For the purpose of calculating accuracy limits obtainable for a given sample size in a general case, we assume that the number of pheasant nests found in a sample of a cover type follows the Poisson distribution, in which the limits of accuracy are given by the equation

$$d^2 = \frac{t^2\ \overline{X}}{n}$$

where d = $\pm$ the 95% confidence limits of $\overline{X}$.
$\underline{t}$ = statistical value corresponding to 95% confidence = 2.00.
X = observed mean nest density in a cover type (nests per acre).
n = area of sample in a cover type (acres).

The observed 1964 values of n and $\overline{X}$, the calculated value of d, the percentage accuracy (d/x) and the total number of nests in each cover type with the 95% confidence limits indicated on the above assumptions are given in Table 1. Row crops (corn and soybeans) are not included since no nests were found in these cover types.

Table 1. Pheasant nesting density -- Sibley Study Area, 1964.

Cover Type	Acres (n)	Nests per Acre ($\overline{X}$)	95% Confidence Limits (d)	Percentage Accuracy (d/$\overline{X}$)	Number of Nests*
Small grains	80	0.61	0.17	28	49$\pm$14
Hay	44	1.92	0.41	21	84$\pm$18
Pasture	41	0.50	0.22	44	20$\pm$9
Strip Cover	37	1.99	0.50	25	79$\pm$20
Non-agricultural	44	0.36	0.18	50	16$\pm$8

* Estimated for a random sample of n acres.

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Reverse calculations from the equation given above show that the area necessary to search for a 25% accuracy varies from 16 acres for a density of 4 nests per acre to 128 acres for a density of ½ nest per acre. Regardless of the density, a total of 64 nests in a cover type will give an accuracy of ± 25% with a confidence of 95%. However, cover types which contribute relatively few nests to the total need not be estimated with the same precision as those contributing more nests; i.e., a 25% error for a cover type contributing 100 nests is more critical by far (±25) than a 50% error for a type contributing 20 nests (±10).

Table 1 shows that in 1964 strip cover and hay, each totalling about 40 acres, provided samples with an accuracy of ±0.5 nest per acre (25%). In order that samples in hay be comparable to that in strip cover (the area of the latter is relatively constant from year to year) it becomes necessary to search at least 32 acres of hay, if the nest density is 2.0 nests per acre. In order to allow for a lower nest density this year, 64 acres of hayfields have been selected at random over the study area for nest searches in 1966. The results are expected to provide an estimate of nest density in hayfields of the same or better accuracy as that in any other cover type.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

The density of pheasant nests on seeded roadside plots during 1963 was 3.1 nests per acre in fencerows and 2.8 nests per acre in the remaining portions of the plots (Table 2); in 1964, the relative densities were reversed with 2.5 nests per acre established in fencerows and 4.0 nests in the remainder of the seeded roadsides. This high relative incidence of nests in that portion of the seeded roadsides outside the fencerows continues in 1965 with nearly three nests per acre compared to only one nest per acre in the fencerows. On the basis of these limited data, it may be concluded that the quality of nesting cover in that portion of the seeded roadsides outside the fencerows has improved over the past 3 years relative to the cover in the adjacent fencerows. Therefore, a shift of nests back into the fencerows adjacent to the seeded plots in future years might indicate the beginning of deterioration of the seedings as quality nesting cover.

On managed control plots there was a pronounced tendency for nesting to be concentrated in the fencerows during all 3 years, indicating that on these plots the preferred nesting cover was found in the fencerows. Thus, in spite of the fact that there was no mowing on the managed control plots, generally higher and denser cover was probably present in most fencerows than on the remainder of the plots.

3. Factors Influencing Distribution and Abundance of Pheasants

W. L. Anderson

Counts of the number of ruptured follicles found in ovaries of 13 hen pheasants collected during May 1966 in Ford and Livingston counties suggest that the "average" hen in the better pheasant range began laying eggs about April 30. The estimated dates on which laying began were arrived at by allowing 1.3 days for each egg (ruptured follicle) laid. Considerable variation occurred among the 13 hens examined. The earliest estimated date on which laying began was April 18 and the latest date was May 9. Although the reasons for this variation are poorly understood, it seems likely that the age of the birds, their physical condition,

Table 2. Densities of pheasant nests on seeded and managed control roadside plots--Sibley Study Area, 1963, 1964 and 1965.

	Acres			Nests			Nests Per Acre			Percent of Area			Percent of Nests		
	1963	1964	1965	1963	1964	1965	1963	1964	1965	1963	1964	1965	1963	1964	1965
Seeded															
Fencerow	1.3	2.0	1.9	4	5	2	3.1	2.5	1.0	8.3	11.1	9.7	9.1	7.4	3.8
Remainder	14.1	15.9	17.9	40	63	50	2.8	4.0	2.8	91.7	88.9	90.3	90.9	92.6	96.2
Totals	15.4	17.9	19.8	44	68	52	2.9	3.8	2.6	100.0	100.0	100.0	100.0	100.0	100.0
Managed Control															
Fencerow	1.0	1.7	1.4	9	10	8	8.6	6.0	5.6	6.9	9.5	7.4	22.0	26.3	24.2
Remainder	14.0	16.0	17.9	32	28	25	2.3	1.4	1.4	93.1	90.5	92.5	78.0	73.7	75.8
Totals	15.0	17.7	19.3	41	38	33	2.7	2.2	1.6	100.0	100.0	99.9	100.0	100.0	100.0

and the predominating weather conditions were instrumental in determining the date on which egg laying began. Collectively, the estimated dates on which the 13 hens begin laying are believed to be about 2 weeks later than normal and probably reflect responses of hen pheasants to the atypically low temperatures that characterized the spring of 1966.

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

Management efforts for quail on the Forbes and Dale areas have primarily entailed planting annual food patches. This effort included the establishment of 177 food patches comprising 54 acres on Forbes and 51 food patches containing 54 acres on Dale in 1965. Food items included in the 1965 plantings were corn, wheat, milo, and German millet.

During the 1965 quail season (November 13 - December 26), 198 quail crops were removed from quail harvested on the Dale and Forbes areas and their contents identified. The 10 food items found to occur most frequently in the crops are shown in Table 3.

Korean lespedeza and acorns were the two food items found most frequently in the crops from both the Dale and Forbes areas. These two food items and common ragweed were the seeds most frequently found in the crops of quail harvested on the areas in 1963 and 1964. All of the food patch items were among the 10 top-ranked foods on the Forbes Area in 1965. However, only one of the food patch items, German millet, occurred among the 10 top-ranked foods on the Dale Area in 1965. It appears that maintaining plants such as Korean lespedeza and common ragweed which need no cultivation in this area, may be as important in terms of the welfare of quail as the establishment of annual food patches.

Table 3. The 10 top-ranked food items (percent occurrence) found in crops of quail harvested on the Dale and Forbes areas in 1965. The Dale sample represents 103 crops (19 empty); the Forbes sample, 95 crops (21 empty).

Food Items	Times Represented	Percent Frequency of Occurrence	Rank
	Dale Area		
Korean lespedeza (*Lespedeza stipulacea*)	60	58	1
Oaks (*Quercus* spp.)	43	42	2
Common ragweed (*Ambrosia artemisiifolia*)	26	25	3
Touch-me-not (*Impatiens pallida*)	25	24	4
Insect fragments	21	20	5
Fall panicum (*Panicum dichotomiflorum*)	16	16	6

German millet (*Setaria italica*)	12	12	7
Sassafras (*Sassafras albidum*)	11	11	8
Small wild bean (*Strophastyles leiosperma*)	9	9	9
Climbing false buckwheat (*Polygonum scandens*)	7	7	10
	Forbes Area		
Oaks (*Quercus* spp.)	44	46	1
Korean lespedeza (*Lespedeza stipulacea*)	31	33	2
Wheat (*Triticum aestivum*)	27	28	3
Milo (*Sorghum vulgare*)	20	21	4
Common ragweed (*Ambrosia artemisiifolia*)	19	20	5
German millet (*Setaria italica*)	18	19	6
Fall panicum (*Panicum dichotomiflorum*)	17	18	7
Smooth crabgrass (*Digitaria ischaemum*)	16	17	8
Corn (*Zea mays*)	15	16	9
Pigweed (*Amaranthus retroflexus*)	13	14	10

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

During the spring of 1966, 19 areas known or reported to contain remnant flocks of prairie chickens were systematically cruised in search of booming grounds. Nine of the 19 areas were in addition to the 10 areas which have been censused annually since 1963. The areas range from 10 to 16 square miles in size.

On or within one-mile of the annual census areas 120 prairie chicken cocks were found in 1966, and 62 other cocks were found on the 9 new areas, thus totaling 182 cocks. Several other southern Illinois areas reportedly containing chickens will be checked as time permits in the future.

The expanding effort to learn the distribution and status of Illinois' remaining prairie chicken population has revealed a second area, besides Bogota, which appears to have high potential as a successful management area if sufficient action is immediately forthcoming. The Farina census area is centered on a 20-mile length of contiguous prairie chicken range extending from prairie farmland west of Steven A. Forbes State Park (Marion County) north to LaClede (Fayette

County) and northwest to an area near Loogootee (overlapping Fayette and Effingham Counties). Seventy-three of the 182 booming ground cocks extant in 1966 were distributed along this range -- in contrast to the relatively isolated flock at Bogota numbering 41 cocks.

Key features of the habitat in the Farina range include (1) a 300 acre farm under Federal Conservation Reserve contract until 1968, (2) several redtop seed meadows (near Loogootee), and (3) the wide strip of native prairie vegetation along the Illinois Central Railroad which extends through the center of the range. These are accidental bits of habitat. What is needed soon is an ecological pattern of nesting refuges 20-80 acres (or larger) in size totaling at least 500-600 acres, deliberately managed to perpetuate the chicken population on the Farina range.

As an initial step toward land management for prairie chickens in the Farina range, about 30 acres on the west side of Forbes State Park is scheduled to be seeded to grassy nesting cover in the fall of 1966. This seeding is to be a sharecropping arrangement made cooperatively by the Illinois Department of Conservation and the Natural History Survey.

6. Rabbit Management — J. A. Bailey, R. J. Siglin

Parathion, an organic-phosphate insecticide, may become widely used in controlling the alfalfa weevil (*Hypera postica*), a pest which has recently entered southern Illinois. The effects of application of 0.5 pound of parathion per acre upon mammals in and around an alfalfa field on the Dixon Springs Agricultural Research Station in Pope County were evaluated during May, 1966. The field was sprayed from a truck.

Two cottontail rabbits were held in an open pen in the field during and for two days after the spraying. Seven other rabbits, captured on the edge of the field, were equipped with collar-mounted radio transmitters and released. Their activity was monitored before and for 2 days after the parathion treatment. Ten pairs (all females) of white laboratory mice were placed in small cages which were distributed throughout the field an hour before treatment. The mice, having previously been conditioned to alfalfa feed, were fed alfalfa from the parathion-treated field while being observed for 2 days after treatment. Ten additional mice, also conditioned to alfalfa feed, were caged within a building and fed alfalfa from the sprayed field.

Wild mice were live-trapped, toe-clipped and released in the experimental field and in a nearby control field prior to spraying. Unfortunately, the field selected as a control was sprayed with 1 pound of malathion (another organic phosphate, less toxic than parathion) per acre on the day following treatment of the experimental field. Mice were snap-trapped in both fields after treatment.

All of the penned and radio-equipped rabbits and white mice survived the experiment. Results of pre- and post-treatment trapping of wild mice in the parathion-treated field and in the malathion-treated field were similar and did

not indicate that a sudden, significant die-off of mice had occurred after insecticide treatment in either field. Although no evidence of mammal mortality could be detected, the parathion treatment provided adequate control of alfalfa weevils.

Although parathion is more toxic to vertebrates than most chlorinated-hydrocarbon insecticides, it does not persist in the ecosystem long after application as do the chlorinated hydrocarbons. Since this experiment has indicated no overt mortality to small mammals, the use of the more toxic but non-persistent parathion may be more desirable than use of chlorinated-hydrocarbon insecticides which have persistent, far-reaching and insidious effects upon populations of wild vertebrates.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois July, 1966 Vol. 9, No. 7

1. Pheasant Populations and Land Use W. J. Francis, S. L. Etter

The density of pheasant nests on the Sibley Study Area varies widely among different cover types, as shown by annual nesting studies (Job Completion Report, Project W-66-R-5, Job No. 2, dated July 15, 1965). As many as 3.43 nests per acre have been found in unharvested hay, and as few as 0.28 nest per acre in small-grain fields. As a first step in determining quantitative differences in environmental factors, 129 temperature and humidity measurements were made at a height of 10 cm in a wide variety of cover types during June and July, 1966. The temperature and humidity were also measured at a height of 1 meter on the adjacent roadsides, at approximately the same time, to serve as reference levels to which the measurements within the vegetative cover could be referred.

Cover types were divided into the following classes:

Hayfields -- legumes, chiefly alfalfa and red clover.

Brome - Alfalfa -- experimental plots and roadside strips with these species predominant.

Strip Cover -- Roadsides, fencerows, drainage ditches, etc., excluding brome - alfalfa and grasses.

Grasses -- Pastures and roadsides predominantly of bluegrass or uncultivated grasses other than brome.

Small Grains -- Oats and wheat.

Row Crops -- Corn and soybeans.

Although there were considerable day-to-day variations, in all cover types, in the departures of the temperature and humidity values within the cover from the reference values at 1 meter, the means showed consistent differences among cover types (Table 1).

Table 1. Mean temperature and relative humidity at a height of 10 cm within vegetative cover, in relation to corresponding air temperature and relative humidity at a height of 1 meter on the adjacent road edge.

Cover Type	Temperature* (deg. F)	Relative Humidity* (percent)
Hayfields	+1.3 ± 0.6	+8.5 ± 2.5
Brome - Alfalfa	+1.9 ± 1.0	+7.5 ± 3.0
Strip Cover	+1.0 ± 0.8	+7.9 ± 2.4
Grasses	+4.9 ± 1.1	+2.7 ± 1.4
Small Grains	+0.9 ± 1.0	+8.8 ± 3.7
Row Crops	+3.0 ± 0.8	+0.6 ± 1.0

* Mean values ± 1 standard error of the mean.

Examination of the above data shows that in preferred nesting cover (hay, brome - alfalfa, strip cover), the temperature departs only slightly from the free air temperature, and the relative humidity is appreciably higher. In grasses and row crops, the temperature is markedly higher and the relative humidity nearly the same as in the free air. Apparently, these environmental factors play a role in selection of nesting sites by pheasants.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

In 1966, the first search for pheasant nests on manipulated and on managed control plots along 9½ miles of roadway on and near the Sibley Study Area started on June 20 and ended on June 27. Seventy pheasant nests were located on the plots, 44 on seeded plots and 26 on managed control plots. During the first search in 1965, 57 pheasant nests were located, 35 on seeded plots and 22 on managed control plots, while in 1964 the first search revealed 85 nests, 52 on seeded plots and 33 on managed control. In 1963, 44 nests were found on seeded plots and 41 on managed control plots in three searches of the roadsides. Approximately 2½ more acres of seeded and managed control plots were searched in 1966 than in each of the preceding 3 years.

By July 15, 1963, fifteen of the pheasant nests established on seeded plots had hatched, with six hatched on managed control plots (Table 2). This compares with seven nests hatched on seeded and two hatched on managed control plots on the same date in 1964 and with 10 hatched on seeded and five on managed control on this date in 1965. This year, on July 15, both types of roadsides had hatched nearly the same number of nests (8 on seeded and 7 on managed control); when active nests are taken into account, each type of plot has a potential for producing 10 successful nests, based on the findings of the first search of the roadsides. The greatest number of successful nests produced in 1 year on managed control plots was eight in 1965, and in all 3 preceding years seeded roadsides produced approximately twice as many hatched nests as did managed control roadsides. However, the data so far collected this year indicate that successful nest production on managed control roadsides may equal that on seeded roadsides. The second search of the roadsides will be conducted during the last week of July.

Table 2. Status of pheasant nests on seeded and on managed control roadside plots along 9½ miles of roadway on and near the Sibley Study Area, July 15, 1963, 1964, 1965, and 1966.

Status of Nests	Number of Nests							
	Seeded Plots				Managed Control Plots			
	1963	1964	1965	1966	1963	1964	1965	1966
Hatched	15	7	10	8	6	2	5	7
Active	0	0	0	2	0	0	1	3
Abandoned and/or Destroyed*	25	45	25	34	34	31	16	16
Total	40	52	35	44	40	33	22	26

* Includes nests abandoned but not destroyed.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

Eighteen hen pheasants were collected during June 1966 from the state's better pheasant range, primarily Ford and Livingston counties, and were dissected to gain insight into the general physical condition and reproductive status of pheasants during the egg-incubating period. Most of these hens were found in hayfields after they had been killed or mangled by mowing machines. An average of 33.0 ruptured follicles was found in the ovaries of each of the 18 hens, thus indicating that the "average" hen pheasant in the better pheasant range laid 33 eggs before beginning to incubate. Such an accomplishment seems remarkable when it is considered that 33 pheasant eggs collectively weigh about 950 grams, a weight equal to that of the hen's entire body. As hen pheasants typically incubate clutches of about 11 eggs (an average of 10.4 eggs was found in the nests of 13 of the collected hens), it appears that the "average" hen laid about 22 eggs, most of which presumably were deposited at random or in dump nests, before establishing a nest for incubation.

In the Monthly Wildlife Research Letter, June, 1966, it was reported that the "average" hen pheasant in the state's better pheasant range began laying eggs about April 30, 1966. This date was arrived at by allowing 1.3 days for each ruptured follicle found in the ovaries of 13 laying (but not incubating) hens collected during May. If the typical incubating hen laid an average of 33 eggs (requiring a 43-day period), as suggested by counts of ruptured follicles, and the incubation period for pheasants is 23 days, the peak of hatching should have occurred during the week of July 2-8 (April 30 + 43 days + 23 days). This tentatively suggests that the peak of hatching in 1966 was about 3 weeks later than normal.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis

The function of whistling by cock quail during the breeding season is not understood. However, whistling activity is generally thought to be a density-dependent characteristic of a population. For this reason, standardized counts of whistling cock quail are made annually throughout the range of the bobwhite.

Counts of whistling cock quail have been made on the Dale Area since 1964 and on the Forbes Area since 1965. In 1966, weekly counts were made from the first week of May until mid-July. The counts were made along standardized routes and were begun 15 minutes before sunrise. At each predetermined stop (12 stops on Dale and 11 stops on Forbes), the number of individual cocks and the number of bobwhite calls were recorded for a 2-minute period.

Based on the weekly counts of whistling, the data suggested that little synchrony of whistling activity existed between the two areas although they are only 25 miles apart (Table 3). The whistle count data for 1965 and 1966 indicated that the dates on which the maximum numbers of cocks were recorded did not always coincide with the dates on which the maximum numbers of calls were recorded. There was an 11-day difference from 1965 to 1966 in the dates on which the maximum numbers of cocks were recorded on the Dale Area, and a 3-day difference on the Forbes Area. The dates on which the maximum numbers of calls were recorded in 1965 and 1966 varied greatly between the two areas and between the 2 years: on Dale the difference was 1 month; on Forbes, 6 weeks. At this time, no explanation can be offered for this discrepancy.

The four counts made in June of 1965 and 1966 were used as a basis for comparing whistling activity on each area for the 2 years (Table 4). The number of cocks and the number of calls heard on Forbes during June 1966 were significantly higher than the numbers recorded in June 1965. The slight decrease in the number of cocks and of calls heard on Dale in June 1966 compared with June 1965 was not statistically significant.

Table 3. Dates that the maximum numbers of cocks and calls were recorded on the Dale and Forbes areas in 1965 and 1966.

	Dale		Forbes	
	1965	1966	1965	1966
Dates most cocks were recorded	June 18	June 7	July 8	July 5
Dates most calls were recorded	June 18	May 19	May 28	July 5

Table 4. Summary of whistling activity by cock quail in June recorded during four counts made at weekly intervals on Dale and on Forbes in 1965 and 1966.

	Dale			Forbes		
	1965	1966	X^2	1965	1966	X^2
Number of Cocks	245	230	.47*	73	106	6.05†
Number of Calls	1,112	1,088	.30*	255	406	34.54††

* Not significant.

† Significant at .05 level.

†† Significant at .005 level.

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier

The prairie chicken population at Bogota remained essentially unchanged between 1965 and 1966, but the range used by the chickens diminished. Two booming grounds used in previous years were defunct and the use of a third ground almost ceased during the spring of 1966. Thus, the booming grounds at Bogota were mostly limited to only two sections in 1966 instead of five sections as in 1965. This seems to be an unhealthy concentration of the Bogota flock.

Often, shrinking prairie chicken range can be correlated with a loss of grassland, which is essential as nesting and brood-rearing cover. Another causative factor became evident during the 1966 booming season at Bogota. One old traditional

booming ground (Klier) declined from seven cocks in February to only one occasionally-present cock in early April (Table 5) -- the time when the ground should have been active with at least the seven original cocks. The apparent reason for the collapse of this ground was not due to habitat deterioration but to harassment by raptors, particularly harriers (Circus cyaneus). As shown in Table 5, an unusual concentration of raptors was observed on or within about ¼ mile of the booming ground. All of the counts shown in Table 5 were made during the first hour of daylight, during which as many as 13 raptors were seen on or near the ground, and on the evening of March 17 at least 20 raptors were counted.

No evidence was found that the raptors were actually killing prairie chickens on the Klier booming ground, but the harassment pressure by harriers was persistent enough through constant flushing and chasing of the cocks to prevent them from establishing booming territories. An unusual concentration of short-eared owls (Asio flammeus) also wintered in the vicinity of the Klier booming ground. Unlike the harriers, however, the shortears were generally on or near the booming ground but were not seen diving at the cocks.

The large concentration of raptors present at Bogota during the winter of 1965-66 may have resulted from an apparently high population of meadow mice (Microtus sp.), which may be a temporary phenomenon. If similar situations develop in future booming seasons, special raptor-control measures may be justifiable to safeguard the welfare of the remnant flock of prairie chickens at Bogota.

Table 5. Counts of prairie chickens and of raptors made during the first hour of daylight on or within ¼ mile of the traditional Klier booming ground during 1966.

Date	Prairie Chickens		Raptors
	Cocks	Hens	
2/7	5		0
2/21	7		8
2/23	7		0
2/25	4		7
3/1	2		13
3/2	5		12
3/8	6		0
3/16	4		9
3/21	4		11
3/25	3	1 ?	7
3/26	0		7
3/27	3		3
3/31	0		4
4/3	2	1	0
4/4	0		9
4/6	1		4
4/9	1		2
4/15	0		0
4/17	0		0
4/23	0		0
4/30	1		1

6. Rabbit Management

J. A. Bailey

During the period March 30th to April 19th, 1966, 10 adult male cottontails were collected from each of two areas on the University of Illinois Farm near Urbana. These animals were examined for parameters of physical condition which might be useful in evaluating the incidence of stress in cottontail populations. The work was done by Mr. Ray Schroeder, graduate student at the University, who has recently been appointed technical assistant on the Survey staff, on a half-time basis, to work on the rabbit project.

Rabbits were collected by trapping on the Orchard area and on the Department of Forestry's area on the University Farm. These areas have quite different habitats. The Orchard presents more variety in habitat types, having many patches of fruit trees, grape arbors, shrubs, and weedy forbs. Much of the Orchard is kept mowed. The area used by the Department of Forestry is primarily wooded, containing many patches of conifers. Little of this area is mowed and, in general, it provides more dense vegetative cover than does the Orchard.

All rabbits were measured and weighed upon capture. Total length was determined by grasping the animal by the head and hind legs, extending the animal, and measuring from the nose to the end of the hind feet. A condition index, the ratio of body weight (grams) to the cube of body length (decimeters), was calculated for each animal. The rabbits were autopsied soon after collection; adrenals and spleens were removed, cleaned of associated tissue, blotted on moist paper, and weighed. These organs were then fixed for 2-4 days in Orth's solution, rinsed 4-6 hours in tap water, and stored in 80 percent alcohol for future sectioning. Cross sections of adrenals, 5 micra thick, were mounted on slides and stained. These sections were projected upon paper and sketched. The relative areas of cortical and medullary tissue in these sections were determined by cutting the sketches from the paper and weighing them. A cortex-medulla ratio was calculated from these weights to indicate the size of the adrenal cortex relative to the size of the adrenal medulla.

Results are presented in Table 6. Adult male rabbits from the Forestry area had significantly larger and more variable spleen weights than adult males from the Orchard. As a result, they also had significantly smaller adrenal-spleen ratios. Animals from the forested area also showed significantly larger and more variable adrenal cortices, as indicated by the cortex-medulla ratios. There were no significant differences between areas in adrenal weights or in condition indices.

This work has suggested some parameters of physical condition which should be examined in future studies of stress in cottontail rabbits.

Table 6. Adrenal and spleen weights, histology of adrenals, and condition indices of adult male cottontails from two areas on the University of Illinois Farm, Urbana. All animals were collected between March 30 and April 19, 1966.

Observation*	Department of Forestry: 10 Rabbits	Orchard: 10 Rabbits	Test Criterion	Reference Value
Average adrenal weight (mg)	157.0	162.7	$t = 0.57^{ns}$	
Variance	387.9	594.2	$F = 1.53^{ns}$	
Average adrenal wt./body wt. (10^5)	13.9	13.4	$t = 0.56^{ns}$	
Variance	2.44	6.25	$F = 2.56^{ns}$	
Spleen weight (mg)	1,102	442	$t = 3.15^{\ddagger}$	$t_{05} = 2.26$
Variance	417,923	22,152	$F = 18.9^{\dagger\dagger}$	$F_{01} = 6.54$
Spleen wt./body wt. (10^5)	98.2	37.8	$t = 3.14^{\ddagger}$	$t_{05} = 2.26$
Variance	3,505	190	$F = 18.47^{\dagger\dagger}$	$F_{01} = 6.54$
Average adrenal/spleen wt.	0.19	0.41	$t = 3.40^{\dagger\dagger}$	$t_{01} = 3.25$
Variance	0.012	0.029	$F = 2.35^{ns}$	
Adrenal cortex-medulla ratio	21.13	15.12	$t = 1.90^{\dagger}$	$t_{10} = 1.83$
Variance	84.24	15.74	$F = 5.35^{\ddagger}$	$F_{05} = 4.03$
Condition index	5.38	5.50	$t = 0.85^{ns}$	
Variance	0.100	0.078	$F = 1.27^{ns}$	

* See text for techniques.
ns = Not significant.
† Significant at the 90 percent level of confidence.
‡ Significant at the 95 percent level of confidence.
†† Significant at the 99 percent level of confidence.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois August, 1966 Vol. 9, No. 8

1. Pheasant Populations and Land Use S. L. Etter

During the nesting season of 1966, eight tagged pheasant hens (three adults, and five young from 1965) were observed on nests. Two additional tagged hens (both young from 1964) were observed on nests in 1965.

Of the total of 10 tagged hens observed on nests in these 2 years, 7 were nesting within 0.5 mile of the sites where they were last observed (Table 1). Five of these seven hens were nesting in the same fields in which they had last been seen. Only one hen (G33) observed as late as May moved more than 0.25 mile to nest. Since the two tagged hens observed on nests in 1965 were not observed after the breakup of winter groups, it was not possible to determine whether they moved before or after being associated in harems.

Although the sample size is small, the above data suggest that while pheasants are capable of moving considerable distances to find suitable nesting cover, they seldom move more than 0.25 to 0.5 mile from the harems to the nesting sites.

Table 1. Distances moved by tagged hen pheasants to nesting sites (from sites where last observed), Sibley Study Area, 1965 and 1966.

Hen Number	Date of Last Previous Observation	Distance Moved to Nest (in miles)
Y52	April 7, 1966	-0.25
Y53	April 7, 1966	-0.25
Y04	October 21, 1965	0.5
B29	January 17, 1966	-0.25
B33	May 6, 1966	-0.25
G33	May 13, 1966	2.25
Y82	April 26, 1966	0.25
Y49	April 23, 1966	0.25
W66	February 17, 1965	1.25
W3V	March 3, 1965	6.0

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2. Manipulation of Pheasant Habitat G. B. Joselyn

The second and final search was made for pheasant nests on manipulated and on managed control roadside plots along 9½ miles of roadway on and near the Sibley Study Area from July 22 through August 1; the first search took place June 20-27 (Monthly Wildlife Research Letter, July, 1966). One hundred and three nests were located on the plots during the two searches, 65 (2.9 nests per acre) on seeded plots and 38 (1.7 nests per acre) on managed control plots (Table 2.).

In 1965, 52 nests (2.6 nests per acre) were located on seeded plots and 33 (1.7 nests per acre) on managed control plots. Sixty-eight nests (3.8 nests per acre) occurred on seeded plots in 1964, compared with 38 nests (2.2 nests per acre) on managed control plots, while in 1963 there were 44 nests on seeded plots (2.9 nests per acre) and 41 nests on managed control plots (2.7 nests per acre).

Thus, nest density on seeded plots in 1966 increased by 0.3 nest per acre over 1965, decreased 0.9 nest per acre from 1964, and was identical to the density in 1963. Nest density on managed control plots was the same in 1966 as in 1965 (1.7 nest per acre) but was below the densities of 1964 and 1963.

The 0.7 hatched nest per acre on seeded plots in 1966 was the lowest density of hatched nests for the 4 years 1963-66, but was not materially below that of 1965 and 1964, whereas the density of successful nests on managed control plots in 1966 (0.6 hatched nest per acre) was the highest for the 4 years. While in the 3 preceding years the density of successful nests on seeded plots has been approximately double that on managed control plots, this year there was little difference in the per acre production on the two types of plots. The relatively large number of hatched nests on managed control plots in 1966 was a result of a higher degree of success among established nests (32 percent) than occurred on seeded plots (23 percent). Managed control plots hatched 17, 13, and 24 percent of the nests established in 1963, 1964, and 1965, respectively, while seeded plots hatched 39 percent of established nests in 1963, 20 percent in 1964, and 29 percent in 1965. There is no apparent explanation for the high degree of success of established nests on managed control plots in 1966, except to suggest that the vegetative succession on these plots (which remained unmowed each of the 4 years until early August) has now produced more secure nesting cover than existed at the outset of the study and up until the current nesting season. It is also possible that similarly favorable vegetative changes relating to security of nesting habitat have not occurred on seeded plots. Analysis of vegetative sampling carried out on seeded and on managed control plots over the past 4 years may reveal the magnitude of the changes which have occurred.

Table 2. Numbers of established and of successful pheasant nests and numbers of established and of successful nests per acre on seeded and on managed control roadside plots, Sibley Study Area, 1963-66.

Year	Acres		Number of Established Nests		Number of Established Nests per Acre		Number of Successful Nests		Number of Successful Nests per Acre	
	Seeded	Control	Seeded	Control	Seeded	Control	Seeded	Control	Seeded	Control
1963	15.4	15.0	44	41	2.9	2.7	17	7	1.1	0.5
1964	17.9	17.7	68	38	3.8	2.2	14	5	0.8	0.3
1965	19.8	19.3	52	33	2.6	1.7	15	8	0.8	0.4
1966	22.4	21.8	65	38	2.9	1.7	15	12	0.7	0.6

3. <u>Factors Influencing Distribution and Abundance of Pheasants</u>

W. L. Anderson

Statistical analyses of data obtained from pheasants collected during late April and May, 1966, indicate that laying hens in the better pheasant range lose, on the average, 5.9 grams with each egg they lay (Table 3). This rate of weight loss was found to be significant at the 95 percent level of confidence. Further analyses disclosed that the decrease in body weight was due primarily to shrinkage of fat deposits and of muscles, especially sternal muscles (Table 3). Internal organs did not decrease as the egg-laying period progressed. Whether the loss of 5.9 grams per egg laid is normal, excessive, or low for pheasants is presently unknown. The full meaning of these findings will have to await collection of comparable data in other years and under differing environmental conditions.

Table 3. Changes in weights (in grams) of the carcass, muscles, fat deposits, and internal organs of 13 hen pheasants collected in Ford and Livingston counties during the egg-laying period of 1966. The 13 hens had laid an average of 12.3±2.2 (range 3-26) eggs.

	Sample Size	Mean Weight	Sample Regression Coefficient*	*t* Value
Carcass	13	1045±21	-5.94	2.21‡
Muscles				
Leg	10	194.8±5.4	-0.76	1.02ns
Sternal	10	242.4±5.0	-1.25	2.04†
Fat Deposits				
Fat Strip	13	2.6±0.5	-0.11	1.86†
Visceral Fat	13	14.9±2.6	-0.66	2.24‡
Internal Organs				
Heart	13	4.1±0.1	-0.01	0.50ns
Liver	13	22.1±0.5	0.00	0.00ns
Gizzard	13	16.6±0.6	-0.03	0.38ns
Ovary	11	20.6±2.6	-0.07	0.00ns
Oviduct	13	18.2±1.1	0.18	1.29ns

* Mean change in weight per egg laid.
† Significant at the 90 percent level of confidence (Ref. t = 1.86 with 8 df and 1.80 with 11 df).
‡ Significant at the 95 percent level of confidence (Ref. t = 2.20 with 11 df).
ns=Not significant.

4. <u>Responses of Bobwhites to Habitat Manipulation</u>

J. A. Ellis

It was possible to determine the overwinter survival rates among the cock segments of the quail populations on the Dale and Forbes areas from data collected during the 1965 harvest and the 1966 spring trapping program. The survival rate of juvenile cocks to that of adult cocks was calculated by using the formula

$$\frac{Nsi}{Noi} = \frac{Nsc\ Nob}{Nsb\ Noc};$$

where

Nsb = number of juveniles in the fall sample,
Nsi = their survival rate,
Nsc = number of juveniles in the spring sample,
Nob = number of adults in the fall sample,
Noi = their survival rate,
Noc = number of adults in the spring sample.

For the winter period of 1965-66 juvenile cocks had survival rates of 1.21 and 1.26 times those of adult cocks on the Dale and Forbes areas, respectively. The survival rates of juvenile cocks for the winter period of 1964-65 were 1.58 and 1.70 times those of adult cocks on the Dale and Forbes areas, respectively.

In a previous report (Monthly Wildlife Research Letter, Vol. 9, No. 5, May 1966), comparisons were made of the numbers of quail found during the post-hunt (January) censuses and the prebreeding (March) censuses for the years 1964-66. The greatest percent losses from January to March occurred in 1965, 64 and 50 percent on Dale and Forbes, respectively. In 1966 the loss from January to March was approximately 20 percent for both Dale and Forbes. The magnitude of these losses (January - March) was influenced by weather conditions. We may assume, therefore, that the survival rate of adult cocks to that of juvenile cocks is greater when the population is not subjected to unusually adverse weather conditions from January to March.

5. <u>Responses of Prairie Chickens to Habitat Manipulation</u> R. L. Westemeier

The fourth annual search for prairie chicken nests on the Yeatter and McGraw sanctuaries at Bogota was conducted between June 20 and July 21, 1966. Private farmlands which were plowed or mowed were searched prior to this period, and other acreages were searched later. In all cases, possible harassment to nesting hens by the searching activities was held to a minimum. The total of 276 acres searched by August 20, 1966, includes 222 acres searched on foot and 54 acres searched with a truck-mounted flushing bar. The flushing bar technique was used in fields that were to be plowed within a few hours or a few days.

Seven prairie chicken nests were found as of August 20 in the following locations: Yeatter Sanctuary, four; McGraw Sanctuary, one; private farmland, two. At least 9 other nests (possibly as many as 16) were reported by farmers, all but 1 of which were destroyed by spring plowing. No nests were found on the 60-acre Donnelley Sanctuary. The other five sanctuaries (newly acquired) were not searched, since they are either not seeded or have recently been seeded and provide either no nesting cover or cover of poor quality.

The five nests found on the Yeatter and McGraw sanctuaries were all successfully hatched nests which produced a minimum of 50 young prairie chickens (Table 4). However, the effectiveness of these two sanctuaries in their present state of management is discouraging from the following standpoints: (1) In 1964, 15 nests were found on the Yeatter Sanctuary, producing 83 chicks, and 2 nests were found on the McGraw Sanctuary, producing 5 chicks. (2) In the spring of 1966, at least 15 hens (possibly as many as 17 individual hens) visited the booming ground that became well established on the plowed portion of the Yeatter Sanctuary. Thus, the 1964 nesting study revealed that a high density of nests was possible on the Yeatter Sanctuary, and the booming ground observations in 1966 showed that

a large number of hens were close at hand to nest there once again. However, a high density of nests did not materialize.

The fact that the redtop on the Yeatter and McGraw sanctuaries is badly deteriorated seems to have been only partly responsible for their lack of attractiveness to nesting prairie chickens in 1966. Patches of relatively good stands of grass were available for nesting on the sanctuaries, but four of the five nests found were in weedy, relatively open, sterile sites. On private farmland, also, all nests reported by farmers or found by project personnel were in red clover, fescue, green wheat, weedy soybean stubble, or weeds. All such sites were characterized by having short (5-10 inches) open cover at the time the hens were selecting nesting sites.

The nesting ecology of prairie chickens at Bogota in 1966 represents an extreme departure from the type of cover shown to be preferred in the past 3 years--i.e., pure dense stands of grass. Such a departure stresses the importance of open-mindedness and long-term research when manipulating habitat for prairie chickens.

Table 4. Summary of data on prairie chicken nests, chick production, and acreage of nesting cover on the Yeatter and McGraw sanctuaries at Bogota, 1963-66.

	1963	1964	1965	1966
Yeatter Sanctuary (77 acres)				
Number of established nests	6	15	4	4
Number of hatched nests	5	9	2	4
Number of chicks produced*	49	83	14	35
Acres of available nesting cover	41.5†	77	77	67
Acres of nesting cover per nest	6.9	5.1	19.3	16.8
McGraw Sanctuary (20 acres)				
Number of established nests	2	2	0	1
Number of hatched nests	2	1	0	1
Number of chicks produced*	15	5	0	15
Acres of available nesting cover	20	20	20	20
Acres of nesting cover per nest	10	10	-	20

* Minimum estimate based on egg remains in nests.
† Excludes new seedings made in the fall of 1962.

6. Rabbit Management — J. A. Bailey, J. C. Hanson

Results of feeding trials conducted with young cottontails during July and August, 1965, were reported in the Monthly Wildlife Research Letters for August and October, 1965. These data permitted comparisons among the midsummer nutritional values of seven plant species to cottontails. The data also suggested that the nutritional values of plants varied with season, according to the phenologies of the species. To demonstrate these seasonal changes, feeding trials have been planned for spring, midsummer, and early autumn, 1966. Preliminary results of the spring trials, conducted during April 21 - May 20, are reported here.

The rabbits, weighing between 141 and 386 grams, were livetrapped near Urbana. They were handled in the same manner as described in the abovementioned reports, except that all trials were terminated after 10 days. Daily food consumption, survival times, and changes in body weight were recorded for rabbits on single-species diets (Table 5). Nine plant species were tested: three domestic grasses, three domestic legumes, and three wild forbs.

The domestic grasses tended to be poorer foods than either the domestic legumes or the wild forbs. Two animals which died and one of two which failed to gain weight during the experiment were fed grasses. The appearance of fecal pellets suggested that bluegrass and orchard grass were less digestible than all other foods tested. Bluegrass appeared to be least palatable and perhaps least nutritious of the grasses, according to daily consumption and weight-change records (Table 5).

Among the legumes, alfalfa and red clover appeared to be palatable and nutritious; sweet clover appeared less palatable and perhaps less nutritious. Among the wild forbs, chicory and prickly lettuce were consumed in greater amounts than any other foods and produced good weight gains, while Rugel's plantain appeared less palatable, yet nutritious.

Of 17 animals in this experiment, all but two survived for 10 days and all but two gained weight during the trials. This was in marked contrast to the midsummer trials reported last year, indicating that nutritional problems are unlikely among wild conttontails during early summer.

Table 5. Results of feeding trials conducted with young cottontails, April 21 - May 20, 1966.

Single-species Diet	Number of Rabbits Tested	Average Daily Consumption of Food (% of body wgt.)*	Average Survival Time, Days† (max.:10 days)	Average Daily Gain in Body Weight (% of original wgt. ‡)
Bluegrass *Poa* sp.	2	37	10.0	1.0
Orchard grass *Dactylis glomerata*	2	46	9.5	2.2
Timothy *Phleum pratense*	2	42	9.0	2.2
Alfalfa *Medicago sativa*	2	42	10.0	4.6
Red Clover *Trifolium pratense*	2	58	10.0	3.3
Sweet Clover *Melilotus* sp.	2	28	10.0	0.4
Prickly lettuce *Lactuca scariola*	2	62	10.0	3.0
Chicory *Cichorium intybus*	2	65	10.0	3.8
Rugel's plantain *Plantago rugelii*	1	27	10.0	2.6

* Food consumption is expressed as the average fresh-weight of food eaten daily, relative to the body-weight of the animal.
† Rabbits were removed from the experiment after 10 days.
‡ Original weight = weight at beginning of test.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois September, 1966 Vol. 9, No. 9

1. Pheasant Populations and Land Use S. L. Etter

The standardized counts of pheasant broods, made on the Sibley Study Area during July and August 1966, revealed 7 percent more broods than were recorded in 1965, but 23 percent fewer than were recorded in 1964. One hundred twenty-two broods were observed along 640 miles of roadside transect (two 40-mile routes were driven weekly), compared with 114 broods in 1965 and 159 broods in 1964. The average size of broods judged to be completely counted was 5.3 chicks, compared with 5.1 chicks in 1965, an increase of 4 percent.

The number of adult pheasant hens observed during July and August along these same 640 miles increased from 234 hens in 1965 to 241 hens in 1966 (3 percent). Forty-nine percent of the adult hens observed in 1966 were broodless, compared with 54 percent in 1965.

The above indices reveal a slight increase in production in 1966 compared with 1965.

The number of adult cock pheasants observed on the standardized counts increased from 113 in 1965 to 179 in 1966 (58 percent). This high proportion of cocks in the population has been apparent during the entire year and can be attributed to a light harvest during the 1965 hunting season.

2. Manipulation of Pheasant Habitat G. B. Joselyn

During the years 1963-66 only a slightly higher rate of success is evident for pheasant nests established on seeded roadside plots, as compared with those established on managed control plots (Table 1). Sixty-one of 229 nests located on seeded plots (26.6 percent) were successful, compared with 32 successful nests of 150 established on managed control plots (21.3 percent). The success on seeded plots has varied from a high of 38.6 percent in 1963 to a low of 20.6 percent the following year, with no marked change evident during the past 3 years. The lowest rate of nest abandonment on seeded plots (11.4 percent) occurred in 1963; since then, this cause of nest failure has been fairly constant at between 19 and 25 percent. On seeded plots, the rate of predation by large mammals has also been relatively constant the last 3 years (approximately 40 percent) but was only 30 percent in 1963; in contrast, predation by ground squirrels has fluctuated, being highest in 1964 and 1966, when 16 and 14 percent, respectively, of the nests were preyed upon by this mammal. The highest rates of nest success on seeded plots occurred during the 2 years of the lowest occurrences of ground squirrel predation (1963 and 1965).

Percentage success of pheasant nests established on managed control plots has increased substantially the past 2 years, the rate in 1966 being nearly 9 percent higher than that on seeded plots. The increasing success of nests on managed control

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Table 1. Fate of pheasant nests (percentages) established on seeded and on managed control roadside plots, Sibley Study Area, 1963-66. Numbers of nests are in parentheses.

Fate of Nests	Seeded Plots					Managed Control Plots				
	1963	1964	1965	1966	1963-66	1963	1964	1965	1966	1963-66
Hatched	38.6(17)	20.6(14)	28.8(15)	23.1(15)	26.6(61)	17.1(7)	13.2(5)	24.2(8)	31.6(12)	21.3(32)
Abandoned	11.4(5)	20.6(14)	25.0(13)	18.5(12)	19.2(44)	36.6(15)	21.1(8)	18.2(6)	26.3(10)	26.0(39)
Destroyed by--*										
Large Mammal†	29.5(13)	41.2(28)	40.4(21)	41.5(27)	38.9(89)	24.4(10)	44.7(17)	48.5(16)	36.8(14)	38.0(57)
Ground Squirrel	4.5(2)	16.2(11)	1.9(1)	13.8(9)	10.0(23)	7.3(3)	10.5(4)	6.1(2)	2.6(1)	6.7(10)
Unknown Mammal	0.0(0)	0.0(0)	3.8(2)	3.1(2)	1.7(4)	7.3(3)	0.0(0)	0.0(0)	2.6(1)	2.7(4)
Avian Predator	4.5(2)	0.0(0)	0.0(0)	0.0(0)	0.9(2)	0.0(0)	2.6(1)	0.0(0)	0.0(0)	0.7(1)
Farm Machinery	2.3(1)	0.0(0)	0.0(0)	0.0(0)	0.4(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
Humans	2.3(1)	0.0(0)	0.0(0)	0.0(0)	0.4(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
Unknown Causes	6.8(3)	1.5(1)	0.0(0)	0.0(0)	1.7(4)	7.3(3)	7.9(3)	3.0(1)	0.0(0)	4.7(7)
	99.9(44)	100.1(68)	99.9(52)	100.0(65)	99.8(229)	100.0(41)	100.0(38)	100.0(33)	99.9(38)	100.1(150)

* Some of these nests may have been abandoned first.

† Fox, raccoon, skunk, and domestic dog.

plots has not resulted from any single factor, although mammal predation was lower in 1966 than in the preceding 2 years, and was essentially the same as in 1963.

Although the 4-year (1963-66) percentage success of the nests established on the two types of plots was similar, higher nest densities on seeded plots have resulted in a larger number of successful nests on the seeded (61 nests) than on the control plots (32 nests). Thus, while seeded plots have not provided substantially more secure nesting cover for pheasants than unseeded roadsides, they have been more attractive to the birds at the time nest sites are selected. These data suggest that it would be appropriate to investigate plant species, for seeding on roadsides, which would not only be attractive to the pheasant hen in search of a nest site but would also provide better protection from mammalian predators than is offered by the grasses and legumes presently occurring on the seeded roadsides.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

Statistical analyses of data presented in the preceding report (Monthly Wildlife Research Letter, August, 1966) indicated that laying hen pheasants lose an average of 5.9 grams body weight with each egg they lay. Similar analyses of data obtained from 14 pheasants collected during June 1966 suggest that hens in the better pheasant range probably continue to lose weight as the sequences of reproduction progress into the egg-incubating period (Table 2). Although the implied decrease in body weight per day of incubation (4.0 grams) was not statistically significant, decreases in weights of fat deposits were significant (at the 95 percent level of confidence); and decreases in weights of the ovary, oviduct, and gizzard approached significance (at the 90 percent level of confidence). Failure of the implied decrease in body weight to approach statistical significance was thought to be a consequence of the near failure to collect hens in early stages of the 23-day incubation period; only 3 of the 14 hens had been incubating for less than 10 days. Therefore, although hen pheasants probably lose weight as the incubating period progresses, the data available at the present time are insufficient to prove it statistically. Meaningful implications of the above findings probably will not become apparent until similar data are collected in succeeding years.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis

With the cooperation of the Department of Conservation, an experimental burning program has been initiated on the Dale and Forbes areas, primarily concentrated on the Dale Area. The purpose of this program is to evaluate the vegetative responses and the use by quail of habitat conditions resulting from burning. Prescribed burning has been an effective tool in the management of bobwhites in the southeastern United States. Burning was recommended because: (1) It results in establishment of early successional stages of grasses and weeds and retards succession of woody plants. (2) Burning eliminates the heavy ground-duff which distinctly limits the usefulness to quail of much habitat potentially capable of supporting increased quail populations. (3) Burning creates a vast amount of edge. (4) Burning stimulates growth of plants and insects which are natural quail foods. (5) Burning is an inexpensive management tool.

On the Dale Area, approximately 50 acres were burned in 11 plots on March 15-16, 1966. Attempts were made to burn three plots comprising 22 acres on the Forbes

Table 2. Changes in weights or measurements of the carcasses, muscles, fat deposits, and internal organs of 14 hen pheasants collected in Ford and Livingston counties during the egg-incubating period of 1966. The 14 hens had been incubating for an average of 14.4 ± 1.3 (range 4-21) days.

	Sample Size	Mean Weight or Mean Length	Sample Regression Coefficient*	*t* Value
Carcass	14	845 ± 24 g	-4.01	0.800^{ns}
Muscles				
Leg	14	175.1 ± 5.2 g	-0.42	0.375^{ns}
Sternal	14	213.8 ± 7.3 g	-0.81	0.526^{ns}
Fat Deposits				
Fat Strip	14	0.9 ± 0.1 g	-0.05	$2.273^{\dagger}$
Visceral Fat	14	5.4 ± 1.2 g	-0.61	$5.755^{\dagger}$
Internal Organs				
Heart	14	3.5 ± 0.2 g	-0.02	0.533^{ns}
Liver	14	14.5 ± 0.7 g	-0.05	0.436^{ns}
Gizzard	14	13.4 ± 0.5 g	-0.17	1.693^{ns}
Ovary	14	2.4 ± 0.6 g	-0.21	1.715^{ns}
Oviduct	14	4.4 ± 0.7 g	-0.24	1.581^{ns}
Intestine	14	98.8 ± 3.3 mm	-0.51	0.752^{ns}
Caecum	14	18.6 ± 6.4 mm	+0.05	0.790^{ns}
Colon	14	10.6 ± 0.2 mm	0.00	0.066^{ns}

* Mean change in weight or length per day of incubation.

† Significant at the 95 percent level of confidence (Ref. *t* = 2.179 with 12 df).

ns = Not significant.

Area on March 31 and April 4, 1966. At this late date, however, much green vegetation had appeared in the plots, and the burns did not achieve the desired results.

Vegetative analyses of burned and nonburned plots were made on the Dale Area during the last 2 weeks of August. Vegetation was sampled with a 1/16-square-meter quadrat. In 10 burned plots, 299 quadrat samples were taken, and 209 quadrat samples were taken in 7 nonburned plots. Plant species were identified, and the percent top cover of each species present and the percent bare ground were estimated. The 10 plant species found to occur most frequently within the quadrats are shown in Table 3.

The most apparent difference between the burned and nonburned plots was in the amount of bare ground. There was an average of 30 and 7 percent bare ground in the quadrats taken in the burned and nonburned plots, respectively. Thus, burning did eliminate much ground-duff and create more edge, and also resulted in more frequent occurrence of two important quail-food plants, common ragweed and Korean lespedeza. These two plants occurred in 37 percent of the quadrats taken in the burned plots. Korean lespedeza occurred in 13 percent and common ragweed in 1 percent of the quadrats taken in the nonburned plots. Thus, the initial effects of burning on the Dale Area are most promising.

Table 3. The 10 most frequently occurring plants found in 299 quadrat samples taken in burned plots and in 209 quadrat samples taken in nonburned plots in August 1966 on the Dale Area.

Species	Times Represented	Percent Frequency of Occurrence
	Burned Plots	
Goldenrod (*Solidago* spp.)	152	51
Rough buttonweed (*Diodia teres*)	117	39
Korean lespedeza (*Lespedeza stipulacea*)	111	37
Common ragweed (*Ambrosia artemisiifolia*)	110	37
Lance-leaf ragweed (*Ambrosia bidentata*)	61	20
Rush (*Juncus* spp.)	52	17
Whiteheath aster (*Aster pilosus*)	45	15
Tickle grass (*Agrostis hyemalis*)	45	15
Bidens (*Bidens* spp.)	35	12
Crabgrass (*Digitaria* spp.)	25	8

	Nonburned Plots	
Goldenrod (*Solidago* spp.)	99	48
Rough buttonweed (*Diodia teres*)	53	26
Serecia lespedeza (*Lespedeza serecia*)	32	15
Whiteheath aster (*Aster pilosus*)	30	14
Rush (*Juncus* spp.)	28	14
Korean lespedeza (*Lespedeza stipulacea*)	27	13
Panic grass (*Panicum huachucae*)	23	11
Tickle grass (*Agrostis hyemalis*)	21	10
Lance-leaf ragweed (*Ambrosia bidentata*)	19	9
Broom-sedge (*Andropogon virginicus*)	17	8

5. Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier

The search for prairie chicken nests on the Bogota Study Area in 1966 involved a total of 252 acres searched on foot and 54 acres searched with a truck-mounted flushing bar. As in past years, local farmers cooperated by reporting nests found during their farming activities.

Although two nests were found in 20 acres of annual weeds and forbs, cover composed predominantly of perennial grasses continued to be highly important for nesting prairie chickens in 1966. As shown in Table 4, 915 acres of grassland cover types have been searched since 1963 in which 41 nests were found (a density of 22.3 acres per nest). By contrast, a search of 490 acres of legumes (mostly red clover) revealed only two nests during the 4-year period (density, 245.0 acres per nest).

However, on the basis of reports from local residents, leguminous types of cover may be more attractive as nesting cover than is generally appreciated. For example, in 1966 a 36-acre field of red clover near the oldest and most stable booming ground on the Bogota Area contained at least 6 nests according to the landowner, but possibly as many as 13 nests according to another farmer who assisted the landowner in plowing the field. All nests were destroyed by the plowing operation. Greater consideration was given to the two reports after searches on foot had been made on a nearby 20-acre undisturbed field of timothy which contained no nests, and a nearby 20-acre redtop seed meadow (McGraw Sanctuary) which contained only one nest.

Thus, for the 89 prairie chicken nests actually seen by or reported to project personnel since 1963 (Tables 4 and 5), 48.9 percent have been in grassland cover

and 35.2 percent have been in cover dominated by legumes. The comparative availability of grassland and leguminous acreages, in percent of the total land area, has ranged from nearly equal availability in 1963 to 11.6 percent grassland and 17.5 percent legumes in 1965. Considerably more legumes than grassland have currently been available to nesting hens, which tends to strengthen the concept that grasses are preferred.

Nevertheless, the highest density of nests (2.4 acres per nest) documented since the project began occurred in 1964 on the Yeatter Sanctuary in a 19.1-acre field of redtop which also had a conspicuous admixture of red clover. Significantly, the clover provided part of the concealment or was near seven of the eight nests found in the field.

From the cultural standpoint, as well as from the standpoint of nesting ecology, legumes are desirable in stands of grass because they can utilize atmospheric nitrogen through the medium of symbiotic nitrogen-fixing bacteria. The nitrogen ultimately becomes available to the grass. In 1966, about 150 acres of grass - legume mixtures and 100 acres of nearly pure stands of grass have been or will be established on the 257 acres acquired as nesting refuges by the Illinois Chapter-The Nature Conservancy.

Table 4. Dominant cover types at the sites of prairie chicken nests found during nest searches on the Bogota Study Area in 1966 and during the 1963-66 period.

	1966			1963-66		
Cover Type	Acres Searched	Nests Found	Acres per Nest	Acres Searched	Nests Found	Acres per Nest
Grasses	211	6	35.2	915	41	22.3
Legumes	75	0	----	490	2	245.0
Green Wheat & Rye	0	0	----	178	0	-----
Weeds	20	2	10.0	20	2	10.0
Totals	306	8		1,603	45	

Table 5. Dominant cover types in the fields in which prairie chicken nests were reported by local residents, Bogota Study Area, in 1966, and during the 1963-66 period.

	Number of Nests	
Cover Type	1966	1963-66
Grasses	0	2
Legumes	7*	29*
Wheat Stubble	0	7
Green Wheat	1	1
Corn Stubble	0	3
Soybean Stubble	1	1
Weeds	0	1
Totals	9*	44*

* Possibly as many as 14 nests were in leguminous cover in 1966, but since two reports for one field varied from 6 to 13 nests, the more conservative number is used.

6. Rabbit Management

J. A. Bailey, J. C. Hanson

Activity of radio-tagged cottontail rabbits was monitored from 4 PM until midnight (CST) on 6 nights in January and 2 nights in February, 1966. Each of the seven rabbits involved were radio-tracked for all or part of 1 to 8 nights. In all, 31 rabbit-nights of data were collected.

During tracking, bearings toward each radio-tagged rabbit were taken simultaneously from two receivers every 15 minutes. These sets of bearings were used to plot rabbit-locations on a map of the study area. Activity of the animals was measured by the distances between all pairs of successive radio-indicated locations obtained about 15 minutes apart.

Activity records were summarized by hourly periods and classified according to the occurrence of snow on the ground during the tracking periods (Table 6). The presence of snow on the ground had a striking effect upon the activity of the seven rabbits; they were less active when there was a trace of snow on the ground and especially inactive when the snow was 4 inches deep. The occurrence of a freezing rain on January 12, when the Urbana weather station recorded 0.23 inch of precipitation, produced no detectable change in the rabbits' pattern of activity.

Table 6. Activity of radio-tagged cottontail rabbits during periods with and without snow on the ground, University of Illinois Farms, 1966.

	No Snow on Ground Jan. 10,12; Feb. 10		Trace of Snow on Ground Jan. 11, 25, 26, 27		Four Inches of Snow on Ground, Feb. 1	
Central Standard Time	Sample Size*	Average Distance Moved (feet)	Sample Size*	Average Distance Moved (feet)†	Sample Size*	Average Distance Moved (feet)†
1600-1700	2	67	10	60	1	28
1700-1800	2	59	17	140	2	28
1800-1900	7	164	17	60	2	48
1900-2000	11	118	16	46	2	20
2000-2100	12	84	16	52	2	17
2100-2200	11	90	16	74	2	22
2200-2300	12	148	16	98	2	18
2300-2400	9	87	16	72	2	22
Total	66		124		15	
Weighted Average		110		77		25

* Sample Size: Each unit equals the average of from one to four 15-minute movements for one rabbit. The same individual was often radio-tracked during several nights.

† Average distance moved equals the mean of distances between successive radio-locations taken at approximately 15-minute intervals.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

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1. Pheasant Populations and Land Use

S. L. Etter

A comparison of the age ratios of cock pheasants (young per adult) captured during prehunt trapping in October and early November with those of cocks captured during posthunt trapping in January and February for the years 1962-65 indicate that juvenile cocks survive only about half as well as adults during the interim period (Table 1). The comparison of the age ratios of cocks killed during the hunting seasons with those of cocks captured during prehunt trapping did not show any significant differences within individual years and were nearly the same when all years were combined.

Since it is unlikely that any differential mortality between the fall trapping period and the hunting season would be equalized by a compensating vulnerability to hunting, it is felt that adult and juvenile cocks are equally vulnerable to both trapping and hunting. Taking this into consideration, the data suggest that the differential mortality between the two age groups is the result of natural factors. A second and more important implication of the above data is that the differential mortality of juveniles apparently occurs after the early part of the hunting season when most of the cocks are shot. This would suggest that the differential mortality rates of juvenile and adult pheasants (see also Monthly Wildlife Research Letter, March, 1966) may be associated with the stress of the onset of winter storms in late November and December.

Table 1. Age ratios of cock pheasants (young per adult) in prehunt and in post-hunt trapped samples and in hunter bag samples, Sibley Study Area, 1962-65. Sample sizes are in parentheses.

	Prehunt	Hunter Bag	Posthunt
1962	12.8 (760)	11.9 (812)	6.9 (63)
1963	9.7 (407)	9.2 (441)	3.8 (29)
1964	6.7 (207)	8.9 (425)	4.0 (20)
1965	8.3 (140)	8.9 (79)	3.5 (36)
Total	10.2 (1,514)	10.1 (1,757)	4.7 (148)

2. Manipulation of Pheasant Habitat

G. B. Joselyn

It is desirable to compare pheasant nest establishment and production on seeded roadside plots with that occurring on "typical" unseeded roadsides on the study area.

Seeded and adjacent managed control (unseeded) roadside plots are mowed each summer only once, after the second search for pheasant nests in late July. Because most farm operators usually mow roadside cover several times each summer, managed control roadside plots are not representative of other roadsides on the study area.

To compare pheasant nesting ecology between seeded and "typical" roadsides,

74 additional roadside segments (unmanaged control plots) were searched each of the last three summers; in 1963 only 42 of the 74 plots were searched. These unmanaged control plots consisted of 32, ¼-mile roadside segments picked at random from that portion of the study area removed from the locale of the seeded and adjacent managed control plots, and 42, 1/8-mile segments which are parts of the plots searched each summer in conjunction with pheasant population and land-use studies. No attempts were made to control the management of these roadsides by farm operators, and from two-thirds to three-fourths of the plots were mowed one or more times during the nesting seasons.

Pheasant nest densities on seeded plots substantially exceeded the densities on unmanaged control plots each of the 4 years (Table 2). The difference ranged from 1.0 nest per acre more on seeded plots in 1965 to 2.1 nests per acre more in 1964. Over the 4-year period, nest densities on seeded plots were twice those on unmanaged control plots. Mowing was probably the most important single factor contributing to this difference in densities. Early mowing of a roadside (mid-May) eliminates it as pheasant nesting cover for that portion of the spring when most nests are started. Because seeded roadsides go unmowed, they not only attract pheasants during the peak of nesting, but are available for late renesting attempts as well.

The data also appear to indicate that seeded roadsides are more attractive to nesting pheasants than the unmowed managed control roadsides, but the close proximity of these two types of plots to each other could cause some interaction to take place, thus affecting nest densities on one or both types of roadsides.

Table 1. Acreage of roadsides searched for pheasant nests, numbers of nests and of nests per acre on seeded, managed control, and unmanaged control roadside plots, Sibley Study Area, 1963-66.

	Treatment*		
	Seeded	Managed Control	Unmanaged Control
Acres			
1963	15.5	14.9	17.7
1964	17.7	17.4	34.0
1965	19.6	19.3	33.4
1966	22.2	22.0	33.0
1963-66	75.0	73.6	118.1
Number of Nests			
1963	44	41	26
1964	68	38	57
1965	52	33	54
1966	65	38	42
1963-66	229	150	179
Number of Nests per Acre			
1963	2.8	2.8	1.5
1964	3.8	2.2	1.7
1965	2.6	1.7	1.6
1966	2.9	1.7	1.3
1963-66	3.0	2.0	1.5

* Includes adjacent fencerows where present.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

In the two previous reports (Monthly Wildlife Research Letters, August and September, 1966), it was demonstrated that the body weight of the "average" hen pheasant in the better pheasant range in Illinois decreases as the egg-laying and egg-incubating periods progress. Further analyses, employing statistical tests of linear regressions, indicate that an inverse relationship also existed between the body weight of hens and the number of eggs they were incubating (Table 3). The decrease in body weight per incubated egg (19.6 grams) was significant at the 95 percent level of confidence. Decreases in the weights of sternal muscles and of the fat strip were also statistically significant. Unfortunately, the reasons for these relationships are not readily apparent. No significant relationship was found between the number of eggs in incubated nests and the number of ruptured follicles counted in ovaries removed from the hens (t = 1.165, not significant at the 90 percent level of confidence; Ref. t = 2.201 with 11 df). Thus, the light weight of hens incubating large numbers of eggs, as compared with the weight of hens incubating lesser numbers of eggs, apparently was not related to the total number of eggs produced.

The apparent inverse relationship between the body weight of hen pheasants and the number of eggs they were incubating might be linked to the age of the birds. The hen segment of the population is usually composed of one to two juveniles per adult during winter and early spring. If juvenile hens, whose average weight is less than that of adult hens, tend to incubate larger numbers of eggs than adults, the reason for this relationship becomes apparent. Additional data collected in future years should prove or disprove this explanation.

Table 3. Relationships, as determined by statistical tests of linear regressions, between the numbers of eggs in incubated nests and weights or measurements of the carcasses, muscles, fat deposits, and internal organs of 13 hen pheasants collected in Ford and Livingston counties during the egg-incubating period of 1966. The 13 hens were incubating an average of 10.4±0.8 eggs.

	Sample Size	Mean Weight or Mean Length	Sample Regression Coefficient*	t Value
Carcass	13	837 g	-19.57	2.816†
Muscles				
Leg	13	172.5 g	- 2.28	1.328ns
Sternal	13	210.8 g	- 6.42	3.470†
Fat Deposits				
Fat Strip	13	0.9 g	- 0.08	1.947‡
Visceral Fat	13	5.3 g	- 0.97	0.789ns
Internal Organs				
Heart	13	3.5 g	- 0.08	1.689ns
Liver	13	14.5 g	- 0.12	0.399ns
Gizzard	13	13.5 g	- 0.24	1.200ns
Intestine	13	99.2 mm	- 0.21	0.158ns
Caecum	13	18.5 mm	+ 0.01	0.050ns
Colon	13	10.6 mm	- 0.19	2.314†

* Mean change in weight or length per egg in incubated nest.
† Significant at the 95 percent level of confidence (Ref. t = 2.201 with 11 df).
‡ Significant at the 90 percent level of confidence (Ref. t = 1.796 with 11 df).
ns = Not significant.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis

Data presented in a previous report (Monthly Wildlife Research Letter, August, 1966) indicated that adult cock quail on the Forbes and Dale areas had higher survival rates during the winter of 1965-66 than in the preceding winter.

The mean weight of adult cocks captured on Forbes during the summer trapping program (mid-May through the first week of July) in 1966 was slightly higher than the mean weight of adult cocks taken during the same period in 1965 (Table 4), but the difference was not statistically significant. On Dale, however, the mean weight of adult cocks in 1966 was significantly lower than that of adult cocks in 1965. The mean weights of subadult cocks from both Forbes and Dale were heavier in 1966 than in 1965. This difference in the means was statistically significant for subadult cocks from Forbes but not significant for those from Dale.

If quail weights can be considered a reflection of habitat conditions, then Forbes appears to have better quail habitat than Dale. Generally, the mean weights of birds captured on Forbes have been heavier than mean weights of those captured on Dale.

Table 4. Mean weights, in grams, of cock quail captured on the Forbes and Dale areas from mid-May through the first week of July in 1965 and 1966.

	Adults		Subadults	
	1965	1966	1965	1966
Forbes				
Sample Size	21	12	132	114
Mean Weight	169.8±2.4	173.0±4.4	164.2±0.3	169.4±1.8
Dale				
Sample Size	9	12	107	78
Mean Weight	172.5±3.9	161.7±2.1	162.7±1.2	164.0±1.1

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

Twenty-four observations of prairie chicken broods, believed to represent at least 16 individual broods, were made on the Bogota Study Area during the summer of 1966, 13 by project personnel and 11 by cooperating local residents. The individuality of broods was determined by age variations between broods and by the distances between observations.

Sixteen hatching dates were established from age estimates for 15 broods and from one clutch of eggs hatched in an incubator. The dates of hatching extended from mid-May to June 28, with June 7 as the estimated mean date of hatching. No accurate hatching dates were available for 1965, but in 1966 the mean date of hatching was 16 days later than in 1964 and 6 days later than in 1963.

Reliable estimates of both the numbers of young and their ages were obtained for 13 of the 16 broods observed in 1966. With an average clutch size of 10.6

eggs (based on six nests found in 1966 that were believed to have complete clutches) and a hatchability level of 98 percent (based on five clutches), an average of 10.4 chicks should have left the average successful nest in 1966. Some indication of the gradual attrition of brood size is given in Table 5. The average number of young per brood declined from 9.3 chicks at 1 week of age to 3.0 chicks at 10 weeks of age. Although the average brood in 1966 was slightly larger than in either 1965 or 1964 (Table 5), less than one-third of the chicks leaving a successful nest in 1966 survived to 10 weeks of age.

As in past years, hay mowing was a mortality factor acting on prairie chicken broods in 1966. At least six members of one brood were killed by hay mowing, and on one occasion a member of a 1-week-old brood was killed by a car as the hen attempted to move her chicks, when disturbed by mowing, across a public road. On two occasions broods were reluctant to leave the unmowed portions of legume fields during the mowing operations; fortunately, both farmers delayed their mowing long enough to allow the chicks to leave the fields. It is hoped that various means can be found to increase the attractiveness of the sanctuaries to broods and thereby increase brood survival.

Table 5. Numbers of young in prairie chicken broods, Bogota Study Area, 1963-66. Sample sizes are in parentheses.

Estimated Age of Young in Weeks	Average Number of Young per Brood			
	1963	1964	1965	1966
1	---(0)	---(0)	---(0)	9.3(3)
2	---(0)	---(0)	1.0(1)	4.0(1)
3	---(0)	---(0)	6.0(2)	---(0)
4	9.0(4)	8.5(2)	7.0(2)	7.3(4)
5	9.0(3)	5.3(3)	---(0)	4.0(1)
6	---(0)	5.3(6)	4.0(1)	---(0)
7	6.0(1)	5.5(2)	1.0(1)	---(0)
8	6.5(2)	---(0)	13.0(1)	4.0(2)
9	---(0)	---(0)	---(0)	3.0(1)
10	---(0)	---(0)	---(0)	3.0(1)
Avg. No. of Young	8.2(10)	5.8(13)	5.6(8)	6.1(13)
Avg. Age of Broods in Weeks	5.4	5.6	4.6	4.7

6. Rabbit Management — J. A. Bailey, J. C. Hanson

Methods for radio-tracking seven cottontail rabbits on the University of Illinois Farms during January and February, 1966, have been described in an earlier report (Monthly Wildlife Research Letter, September, 1966). Some observations of the kinds of habitat used by these animals are reported here. The study area is an intensively managed experimental orchard having well-delineated habitat types arranged in rectangular patterns. Each cover type was classified according to the density of its overstory (more than 2 feet tall) of woody

vegetation. Three density classes were recognized: none; sparse to medium (crowns not touching); and dense (crowns mostly touching, and including grape arbors). The limits of the study area were defined by a line drawn between the outermost radio-locations for all observed animals, and the amount of each habitat type within this area was determined (Table 6).

Habitat-use by the rabbits was evaluated by plotting radio-indicated locations on a cover map. It was assumed that errors inherent in locating radio-tagged rabbits by triangulation were random and would not cause a biased picture of habitat-use.

Use of woody cover by the radio-tagged cottontails is presented in Table 6. On nights with little or no snow on the ground the rabbits spent most of their time in areas with either no woody overstory or a sparse to medium woody overstory. Since these are the most prevalent habitat types on the study area, it is suggested that the animals either (1) preferred areas with little or no woody vegetation, or (2) they were not responding to woody cover as they moved about on these nights. In any case, when there was no snow on the ground these rabbits showed no strong preference for areas of dense woody cover.

However, on February 1, with 4 inches of snow on the ground, the rabbits were less active (see earlier report) and remained in areas with dense woody cover (Table 6).

Table 6. Nighttime use of woody cover (more than 2 feet tall) by radio-tagged cottontail rabbits during winter periods with and without snow on the ground, University of Illinois Farms, 1966.

Amount of Woody Cover (Trees and Shrubs) Present	Percent of Total Observations			Amount of Habitat Type in Study Area (percent)
	No Snow on Ground*	Trace of Snow on Ground†	Four Inches of Snow on Ground‡	
None	37	29	0	50
Sparse to Medium: Crowns Not Touching	39	39	0	33
Dense: Crowns Mostly Touching††	20	30	100	14
Unclassified	3	2	0	3
Total Observations	284	466	46	

* Three nights of tracking involving 7 rabbits; 12 rabbit-nights in all.
† Four nights of tracking involving 5 rabbits; 17 rabbit-nights in all.
‡ One night of tracking involving two rabbits.
†† Includes grape arbors.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois November, 1966 Vol. 9, No. 11

1. Pheasant Populations and Land Use S. L. Etter

A ratio of 3.9 young pheasants (both sexes) per adult hen was found among 346 pheasants captured on the Sibley Study Area during October and early November, 1966, whereas a ratio of 3.0 young per adult hen was found among 385 pheasants captured during the same period in 1965. In 1966, age ratios within sexes were 2.1 young hens per adult hen and 6.1 young cocks per adult cock; comparable figures for 1965 were 1.6 for hens and 9.2 for cocks.

These data suggest (1) a higher rate of production (or increased juvenile survival) in 1966 than in 1965, (2) a higher rate of adult hen mortality in late summer and early fall of 1966 than during the same period in 1965, (3) or both. It appears from the data on the numbers of hens and broods observed along standardized routes during both years (Monthly Wildlife Research Letter, September, 1966) that the higher ratio of juvenile pheasants per adult hen in 1966 was the result of higher production (or increased juvenile survival, or both) rather than increased adult hen mortality.

2. Manipulation of Pheasant Habitat G. B. Joselyn

Data presented in the October Monthly Wildlife Research Letter showed that for the 4 years, 1963-66, pheasant nest densities on seeded roadside plots (3.0 nests per acre) exceeded those on managed control plots (2.0 nests per acre) and on unmanaged control plots (1.5 nests per acre). Unmanaged control plots are representative of "typical" unseeded roadsides on the study area.

Densities of established nests on the above three types of roadsides were compared with corresponding data, for the years 1963-66, obtained from 100, 10-acre plots on the Sibley Study Area (Table 1). During each of the 4 years, seeded roadsides had a greater density of pheasant nests than any of the seven cover types on the 100, 10-acre plots, except unharvested and harvested tame hay in 1963. Over the 4-year period the cover type most similar to seeded roadsides (unharvested tame hay) had 1.3 fewer nests per acre (43.3 percent) than seeded roadsides. Nest densities on managed control plots also compared favorably with densities recorded from the seven cover types. In 1963, both types of hayfield cover on the study area, and in 1964, one type (unharvested tame hay), exceeded managed control roadsides in density of nests per acre, and, in 1964, density of nests in strip cover was the same as on the managed control plots. With these exceptions, managed control roadsides showed a greater nest density than any of the seven cover types during each of the 4 years.

Table 1. Establishment rates (nests per acre) of pheasant nests on three types of roadside plots and in seven cover types, Sibley Study Area, 1963-66.

	Nests per Acre				
	1963	1964	1965	1966	1963-66
Seeded Roadsides	2.8	3.8	2.6	2.9	3.0
Managed Control Roadsides	2.8	2.2	1.7	1.7	2.0
Unmanaged Control Roadsides	1.5	1.7	1.6	1.3	1.5
Strip Cover	1.5	2.2	1.1	1.3	1.7
Unharvested Tame Hay	3.2	2.8	1.0	0.3	1.7
Harvested Tame Hay	3.1	1.9	1.4	0.3	1.6
Pastures	1.1	0.5	0.2	0.5	0.7
Small Grains	0.4	0.6	0.1	0.1	0.3
Nonagricultural	0.3	0.2	0.1	0.2	0.2
Row Crops*	0.1	0.1	0.0	-	-

* Row crops were not searched in 1966. All nests located in this cover type during 1963 and 1964 were in soybeans.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

The assimilation of data collected during a 7-month period in 1966 has revealed some interesting aspects of the seasonal dynamics of body reserves in hen pheasants (Table 2). Hens gain weight rapidly during late winter, achieving their heaviest weight immediately preceding the laying period. After laying begins, they steadily lose weight throughout the laying and incubating periods, and during the early stages of the brooding period. It apparently is during this latter period that the hens' body reserves are at their lowest ebb. Weights of muscles and of fat deposits--which serve as indices of the abundance of protein and fat reserves--fluctuated in synchrony with changes in body weight. Thus, both protein and fat reserves are mobilized by hen pheasants during the laying, incubating, and brooding periods.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis

The results of the prehunt censuses of quail on the Dale and Forbes areas in 1966 produced population estimates higher than the prehunt estimates obtained in 1964 and 1965 (Table 3). More quail (327) were found on the Dale Area this fall than during any of the preceding 3 years. The prehunt estimate for 1966 exceeded the prehunt estimate for 1965 by 61 percent. The fall population on Forbes in 1966 (314) was exceeded only by the fall population in 1963 (349). The prehunt estimate for Forbes in 1966 was 52 percent higher than the prehunt estimate in 1965.

Quail population densities on both Dale and Forbes in 1966 were higher than in any year (1963-66) except 1963. Management practices for quail and rabbits were initiated in 1962 on Dale and in 1963 on Forbes.

The increases in population from spring to fall (summer gain), 567 percent on Dale and 648 percent on Forbes, were indicative of phenomenal reproductive success on both areas. On Forbes, for example, the prebreeding population in 1966 was 42

Table 2. Mean weights (in grams) of the carcasses, muscles, fat deposits, and reproductive organs of hen pheasants collected in Ford and Livingston counties during various periods of the life cycle. Percent changes from the previous period are in parentheses.

	Winter (February)	Prenesting (April)	Laying (April-May)	Incubating (June)	Brooding (July-August)
Number of Hens	7	6	13	14	7
Carcass	906±31	1,069±48 (+18)	1,045±21 (-1)	845±24 (-19)	770±14 (-9)
Muscles					
Leg	186.2±7.3	200.7±7.4 (+8)	194.8±5.3 (-3)	175.1±5.2 (-10)	181.5±5.3 (+4)
Sternal	257.4±5.3	266.0±10.0 (+4)	242.4±5.0 (-9)	213.8±7.3 (-12)	184.2±4.6 (-14)
Fat Deposits					
Fat Strip	1.1±0.3	4.7±1.0 (+327)	2.6±0.5 (-45)	0.9±0.1 (-65)	0.2±0.1 (-78)
Visceral Fat	4.7±1.2	24.8±4.8 (+428)	14.9±2.6 (-40)	5.4±1.2 (-64)	0.7±0.2 (-87)
Reproductive Organs					
Ovary	0.2±0.0	2.1±1.0 (+950)	20.6±2.6 (+881)	2.4±0.6 (-88)	0.4±0.1 (-83)
Oviduct	0.4±0.1	5.8±2.2 (+1,350)	18.2±1.1 (+214)	4.4±0.7 (-76)	0.9±0.1 (-80)

birds, 21 of these being hens, assuming a 1:1 sex ratio. If all the adults survived to November, the fall population would consist of 272 juveniles and 42 adults. Thus, each adult hen would have produced an average of 13 chicks that survived to November. Production of this magnitude is difficult to explain under the present concepts of reproductive capacities of bobwhites.

Table 3. Results of prehunt censuses (using dogs) of quail populations on the Forbes and Dale areas, 1963-66.

	1963	1964	1965	1966
DALE				
Prehunt Estimate	297	286	203	327
Quail per 100 Acres	40.1	26.9	18.5	29.7
Percent Summer Gain	-	522	383	567
FORBES				
Prehunt Estimate	349	268	206	314
Quail per 100 Acres	23.2	12.2	9.4	14.2
Percent Summer Gain	-	129	178	648

5. <u>Responses of Prairie Chickens to Habitat Manipulation</u> R. L. Westemeier

The cover types associated with 24 observations of prairie chicken broods were recorded during the summer of 1966 on the Bogota Study Area. Cover types associated with the 24 observations were grouped into three categories to gain insight into the types of habitat selected by broods (Table 4).

Cover type in which brood was first seen -- Redtop seed meadows, an important type of nesting cover for prairie chickens, accounted for 21 percent of these observations. Soybean fields and roadside grass - forbs each ranked second (17 percent each).

Nearest different cover type -- Soybeans ranked first (52 percent of 23 observations of broods) and redtop seed meadows and wheat stubble - legume fields each ranked second (13 percent each).

Cover type to which brood moved -- These cover types were known for 18 of the 24 observations. Soybeans ranked first (28 percent), wheat stubble - legumes ranked second (22 percent), and redtop seed meadows and undisturbed timothy each ranked third (11 percent each).

Even though soybean acreage is nearly twice as great (40 percent of the total land area in 1965) as corn acreage on the study area, corn is one cover type noticeably absent from Table 4. The edges of soybean fields, when adjacent to grass, legumes, or small grain stubble, provide situations which are apparently important to broods -- perhaps for dusting, for drying off in wet weather, and for insect availability. The prairie chicken sanctuaries at Bogota are needed primarily for provision of nesting cover, but several narrow strips of soybeans, designed as firelanes, might be attractive to hens with broods.

Legumes are readily used by nesting hens, and the mowing of legumes appears to attract broods (Monthly Wildlife Research Letters, September and October, 1966). To maintain insect availability for the growing chicks, a limited acreage of legumes seeded and mowed for hay may be desirable provided the mowing can be done with minimum danger to broods. Legume fields at Bogota which were mowed several times by farmers during the summer of 1966 stayed green and maintained an abundant supply of insects. Conversely, the Yeatter and McGraw sanctuaries, which were searched on foot for nests from late June through July, the critical brood-rearing period, were noticeably lacking in insects and in evidence of use by broods. The sodbound and deteriorated nature of the perennial grasses on these sanctuaries appears to be unattractive to broods. Thus, on the portions of each sanctuary not set aside for prairie establishment, it seems advisable to try a limited amount of soybean and of mowed legume edge for prairie chicken broods.

6. Rabbit Management

J. A. Bailey, J. C. Hanson

Methods for radio-tracking cottontail rabbits, and some observations of activity patterns of seven rabbits and of habitat-use by these rabbits during winter nights were reported in the Monthly Wildlife Research Letters for September and October, 1966. Observations of the kinds of herbaceous vegetation used by these animals are reported here (Table 5). Each cover type on the study area was classified according to the ground-cover conditions described in Table 5. Habitat-use by the rabbits was evaluated by plotting observations of radio-indicated locations on a cover map.

On nights with little or no snow on the ground the animals spent most of their time on either mowed or plowed ground (mostly mowed ground: only 4 percent of the area had been plowed). A freezing rain on January 12 did not alter this pattern of cover-use. However, 68 percent of the study area consisted of plowed or mowed ground. Thus, although the rabbits may have preferred mowed or plowed areas, it is also possible that they were not responding to this cover type and that their movements were essentially random with respect to these areas.

Only 2 percent of the study area consisted of unmowed grasses. However, on nights with no snow or only a trace of snow on the ground, 17 and 11 percent of the rabbit-observations, respectively, fell in this cover type, indicating that the rabbits were attracted to it.

On February 1, with 4 inches of snow on the ground, the rabbits were less active and remained in areas with dense woody cover (see earlier reports). Herbaceous cover in these areas was either unmowed or had been mowed in strips among grape arbors. These changes in amount of activity and use of cover on February 1 are the most conspicuous features of data reported here and in the two earlier reports.

Since these rabbits showed no strong preference for dense woody cover during nights with little or no snow on the ground, it is possible that good cottontail habitat need not contain large amounts of woody cover, at least in southern Illinois, where snow does not lie on the ground for long periods. The extensive use by the rabbits of areas with open cover (mowed ground with little or no woody vegetation), during these nights, suggests that either the animals were attracted

Table 4. Ecological aspects of 24 observations of prairie chicken broods, Bogota Study Area, June 9 - August 9, 1966.

Category	Number of Observations	Percent of Observations
Cover type in which brood was first seen		
Redtop Seed Meadow	5	21
Soybeans	4	17
Roadside Grass - Forbs	4	17
Legume Hay Meadow	2	8
Weedy New Timothy Seeding	2	8
Shrubby Fencerow	2	8
Green Wheat	1	4
Field Lane	1	4
Grass Pasture	1	4
Fescue Waterway	1	4
Wheat Stubble	1	4
Nearest different cover type		
Soybeans	12	52
Redtop Seed Meadow	3	13
Wheat Stubble - Legume	3	13
Green Wheat	2	9
Weedy New Timothy Seeding	1	4
Shrubby Fencerow	1	4
Undisturbed Sweet Clover	1	4
Unknown	1	--
Cover type to which brood moved		
Soybeans	5	28
Wheat Stubble - Legume	4	22
Redtop Seed Meadow	2	11
Undisturbed Timothy	2	11
Weedy Legume Hog Pasture	1	6
Weedy New Timothy Seeding	1	6
Green Wheat	1	6
Shrubby Fencerow	1	6
Undisturbed Sweet Clover	1	6
Unknown	6	--

to food present in these areas (mostly grass) or that they preferred areas which allowed maximum visibility and mobility. These hypotheses remain to be tested.

The fact that these rabbits became less active and confined their activity to dense woody cover when snow lay on the ground also suggests several hypotheses: (1) Since this was the only appreciable snow during the winter of 1965-66, the rabbits may have been "shocked" by the strangeness of snow. It would be difficult to interpret the animals' reaction to this snow solely as an aversion to its coldness or wetness because the freezing rain which occurred earlier did not cause similar curtailment of their activity. (2) The 4 inches of snow covered all herbaceous vegetation in mowed areas. Perhaps the animals would not dig through snow to obtain food in these areas and preferred to feed upon the exposed stems of woody plants. (3) The rabbits may have sensed that they were conspicuous against the expanse of unbroken snow and preferred to remain in woody cover for its camouflage value.

Table 5. Nighttime use of herbaceous cover by radio-tagged cottontail rabbits during winter periods with and without snow on the ground, University of Illinois Farms, 1966.

Type of Herbaceous Ground Cover	Percent of Total Observations			Amount of Habitat in Study Area (percent)
	No Snow on Ground*	Trace of Snow on Ground†	Four Inches of Snow on Ground‡	
Plowed or Mowed Ground	57	52	0	68
Unmowed Grasses	17	11	0	2
Unmowed Weedy Forbs or Mixed Grasses and Forbs	11	22	20	7
Partly Mowed (strips mowed among grape arbors)	11	11	80	9
Unclassified	4	3	0	14
Total Observations	284	466	46	

* Three nights of tracking involving 7 rabbits; 12 rabbit-nights in all.
† Four nights of tracking involving 5 rabbits; 17 rabbit-nights in all.
‡ One night of tracking involving two rabbits.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | December, 1966 | Vol. 9, No. 12

1. Pheasant Populations and Land Use

S. L. Etter

The success of hunters on the Sibley Study Area during the 1966 pheasant hunting season was slightly higher than in 1965. Hunters interviewed during the 1966 season bagged a cock, on the average, every 6.2 hours, whereas an average of 8.0 hours were required to bag a cock in 1965. Both these success rates were considerably lower than those in 1962, 1963, and 1964, when 3.3, 3.1, and 2.4 hours per bagged cock, respectively, were spent in the field.

The slightly higher success rate in 1966 did not, however, result in a greater proportionate harvest. To date, 20.3 percent of the tags from cocks captured in October and early November, 1966, have been returned. In 1965, 20.0 percent of these tags were returned. Although these figures must be increased by about one-third to account for crippling loss and the failure of hunters to return all tags, it is obvious that the harvests were light and nearly equal in the last two seasons. These data tend to confirm field observations that there were fewer pheasant hunters in 1966 than in recent years, but that those who were in the field enjoyed slightly better hunting.

During both the 1965 and 1966 hunting seasons the success rates of hunters were higher during the period following the opening weekend than during it. This is a complete reversal of the situation which prevailed from 1962 through 1964. These data suggest that the success rates and proportionate harvests in 1965 and 1966 were at least as strongly influenced by the large acreages of corn which remained unharvested well into the hunting seasons as by the lower pheasant populations of the past 2 years.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

For the years 1963-66, the number of successful pheasant nests per acre on seeded roadsides (0.8 nest per acre) was at least twice that on managed and on unmanaged control roadsides and in each of six other cover types on the Sibley Study Area. Managed and unmanaged control roadsides each had 0.4 hatched nest per acre over the 4 years, as did strip cover and unharvested tame hay on the study area. Pastures (tame hay and bluegrass) produced 0.2 successful nest per acre, while small grains (oats and wheat), harvested tame hay, and nonagricultural areas produced only 0.1 hatched nest per acre during the same period. It is particularly significant that per acre production in the cover type most closely resembling seeded roadsides (unharvested tame hay) was only half that on seeded roadsides. This may be partly because the cover in the unharvested hayfields on the study area is of lower quality than that on the seeded roadsides; most, if not all, of such hayfields are in the Federal Feed Grain Program, which prompts many farmers to use light seeding rates in their establishment, resulting in pheasant nesting cover of low quality.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

There is a general consensus that the period of greatest stress for adult pheasants is during the molt, which occurs in late summer and early fall. During this period, body reserves are mobilized to provide nutrients for rapidly developing feathers and, in hens, for energies required for brooding and caring for chicks. The body weight of hen pheasants is at its annual low during the brooding and molting period (Monthly Wildlife Research Letter, November, 1966).

The severity of the stress to which pheasants, as well as other birds, are subjected has long been associated with the degree of activity of the adrenal glands. The greater the adrenal activity, presumably the greater is the stress on the birds. However, the mean weight of adrenals excised from hen pheasants collected in Ford and Livingston counties in 1966 was less during the brooding and molting periods (47 mg) than during the three preceding periods: prenesting (58 mg), egg laying (55 mg), and egg incubating (53 mg). Also, and perhaps more important, the thymus, a lymphoid organ that is suppressed by adrenocortical secretion, dramatically increased during the brooding and molting period, the mean weight being 313 mg as compared with 52, 13, and 26 mg, respectively, during the three preceding periods. These findings tentatively indicate that although hen pheasants are indeed at a low ebb with respect to metabolic reserves during the molt, they are not necessarily stressed--via the adrenal--during this period.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis, K. P. Thomas

The rate of capture of quail by the cock-and-hen trapping technique was apparently not an indicator of population abundance on the Dale and Forbes areas in the summers of 1965 and 1966. On the Dale Area, 1.50 and 1.08 quail were captured per trap day in 1965 and 1966, respectively. This difference in rates of capture per trap day was statistically significant at the .05 level ($X^2 = 6.21$). On Forbes, however, 0.88 and 0.82 quail were captured per trap day in 1965 and 1966, respectively. In contrast, whistle count data indicated that the number of whistling males was similar on the Dale Area in 1965 and 1966 and was four times greater on Forbes in 1966 than in 1965.

The response of quail to the cock-and-hen trapping method during a particular summer apparently was associated with factors other than the numbers of males in the populations. Perhaps the late winter sex ratio determined the trap response by males during these 2 summers.

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier

During the fall of 1966 an attempt was made to census the prairie chicken population on the Bogota Study Area by systematically checking the five booming grounds which were used during the preceding spring. Counts were made on 6 warm, clear, calm mornings during the first hour of daylight, at about weekly intervals, during the period from October 5 to November 17.

Three of the five booming grounds used during the spring of 1966 were found to be active during the fall of 1966. The total counts of prairie chickens for the

three grounds were 31, 54, 83, 56, 50, and 39. The high count of 83 chickens was made on October 20. It was difficult to distinguish the sexes because of the halfhearted nature of booming in fall and the incomplete development of plumage. However, most of the birds involved in the high count of 83 were believed to be cocks. This is encouraging because the high count during the spring of 1966 was 41 cocks. Theoretically, therefore, the Bogota population could sustain a winter mortality as high as 50 percent and still maintain a breeding population in 1967 equal to that of 1966.

Supplemental to the booming ground counts were several reports received from local farmers regarding prairie chicken flocks numbering as high as 80 birds in the fall of 1966. Also, counts of this magnitude were reported to be more numerous than in several recent years.

The booming ground on the Yeatter Sanctuary appeared to be the focal point of fall booming activity on the study area, from two standpoints: it was the most consistently active of the three booming grounds used and had the largest number of prairie chickens.

Previous to the fall of 1966 only two sanctuaries (Yeatter--77 acres and McGraw--20 acres) of the eight sanctuaries now in the 494-acre refuge system were regularly used by prairie chickens for nesting and roosting activities. Although no nests were found on the 60-acre Donnelley Sanctuary in 1966, it is encouraging to note that prairie chickens are now using this sanctuary regularly for night-roosting and day-resting activities. The five other sanctuaries are in early stages of cover development, but they should expedite greater dispersal of the Bogota flock, beginning in 1967.

6. Rabbit Management

J. A. Bailey, J. C. Hanson

Results of feeding trials conducted during spring and summer with young cottontails have been reported (Monthly Wildlife Research Letters, August and October, 1965, and August, 1966). Feeding trials conducted during September and October, 1966, with cottontails weighing between 435 and 735 grams are reported here. Twelve animals were fed single-species diets during the 10-day trials. Bluegrass (*Poa* sp.), orchard grass (*Dactylis glomerata*), timothy (*Phleum pratense*), alfalfa (*Medicago sativa*), and chicory (*Cichorium intybus*) were fed to two animals each. Rugel's plantain (*Plantago rugelii*) and Lamb's-quarters (*Chenopodium album*) were fed to one animal each.

The most palatable foods were chicory and alfalfa. The rabbits consumed these foods at rates of 45 percent and 30 percent of their body weights per day, respectively (fresh-weight basis). Least palatable were bluegrass and timothy, each of which was consumed at a rate of 12 percent of body weights per day. Only one animal, fed timothy, failed to survive for 10 days. Rabbits fed single-species diets of bluegrass, timothy, and Lamb's-quarters lost weight, while rabbits fed single-species diets of orchard grass, alfalfa, chicory, and plantain gained weight during the experiment. Greatest weight gains were made by animals fed chicory and plantain. The digestibilities of dry matter in six of the foods were: bluegrass, 44 percent; orchard grass, 46 percent; timothy, 50 percent; alfalfa, 62 percent;

chicory, 84 percent; and Lamb's-quarters, 73 percent. A digestion coefficient could not be determined for Rugel's plantain because the animal fed this food experienced diarrhea. These data indicate that chicory is an excellent food for cottontails during the fall (as it is during spring and summer), and that, in general, grasses are less digestible cottontail foods than are broad-leaved plants.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson, Editor

Urbana, Illinois | January, 1967 | Vol. 10, No. 1

1. Pheasant Populations and Land Use — S. L. Etter

During the opening weekend of the 1964 hunting season, hunters on the Sibley Study Area bagged 28 percent of the available cocks, as indicated by band returns. The remainder of the $36\frac{1}{2}$-day season added only an additional 7 percent, resulting in a harvest of 35 percent for the entire season. In contrast, during the 3-day opening weekend of the 1966 hunting season, only 8 percent of the available cocks were killed. The low kill during the opening weekend in 1966 was partially compensated for by the harvest of an additional 16 percent of the available cocks during the remainder of the $29\frac{1}{2}$-day season, giving a total of 24 percent for the season.

The above data suggest that a longer hunting season in 1966 might have resulted in nearly as high a proportionate harvest as in 1964 in spite of the low kill on the opening weekend in 1966. The low overall proportionate kill in 1964, on the other hand, suggests that below a certain level of abundance, few additional cocks are killed in spite of longer seasons. Thus, it appears that longer seasons would result in more nearly equal proportionate harvests from year to year, and would prevent low harvests such as occurred in 1965 and 1966 when late corn harvests prevented good hunting during the early part of the seasons. More liberal hunting regulations, therefore, appear to be highly desirable for both the increased recreation which could be provided and the sound management of the available resource.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

For the past several years, land-use trends on the Sibley Study Area have been toward increased acreages of row crops at the expense of tame hay, pasture and small grains. Of particular significance from the standpoint of pheasant production is the reduced acreage of hay and pasture on the study area; the reduction of this cover type raises the question of whether the pheasant will be able to maintain itself at levels acceptable for hunting in the future. About 44 percent of study area is made up of the Sibley estate which is tenant-farmed under the supervision of two farm managers. Since 1964 hayfields (harvested and unharvested) and pastures (grazed hay and grazed bluegrass) have annually constituted less than 2 percent of the land area on the estate farms. As a result of the nearly complete elimination of hay and pasture from the estate farms, it has appeared that land-use on the study area might be more advanced in the trend toward row crops than the remaining farm land in the prime range of the pheasant in east-central Illinois.

Data from the U. S. Department of Agriculture on land-use in the four counties (Ford, Livingston, McLean, and Iroquois) constituting the major center of pheasant abundance in Illinois have been analyzed. These data show that the proportion of the land in the four counties in hay and pasture has decreased from about 18 per-

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cent during the years 1951 to 1958 to about 10 percent in 1965; small grains made up about 20 percent of the land area in the four counties in the early 1950's but only 5 percent in 1965. On the study area, in spite of the influence of estate land farming practices, the trend toward less hay, pasture and small grain has been only slightly more accelerated than in the four-county area, indicating that land-use practices on the study area are generally indicative of those throughout the remainder of east-central Illinois.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

Statistical analysis of data obtained from 15 adult hens collected in Ford and Livingston counties during July through October, 1966, indicates that a direct relationship exists between the body weight of pheasants and the progression of molt of their primary flight feathers. The increase in body weight with each primary molted averaged 16.6 grams among the 15 hens; this increase was statistically significant at the 95 percent level of confidence. The bulk of the increase in body weight apparently was due to accumulation of fat deposits and to increases in the size of sternal muscles. The fat strip and visceral fat, which are useful as indices of the abundance of fat, increased an average of 0.05 and 0.15 gram, respectively, with each primary molted, both of which were highly significant (99 percent level of confidence). Sternal muscles increased, on the average, 5.4 grams with each primary molted, which was also significant at the 99 percent level of confidence. Increases in leg muscles, which averaged 2.2 grams with each primary molted, exhibited only a low degree of significance (90 percent level of confidence). Thus, it appears that following the nesting season, adult hens steadily replace depleted body reserves concurrent with developing new plumage--a phenomenon that requires approximately 16 weeks.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis, K. P. Thomas

The increase in the harvest of quail on the Dale and Forbes areas in 1966 marked an end of the declining success of hunters compared to the preceeding 3 years. During the 1966 season on Dale, 665 gun-hours were expended, and 206 quail were harvested (3.2 gun-hours per kill which was 37 percent less effort per bird killed than in 1965). The kill per 100 acres in 1966, 18.7, was 39 percent higher than in 1965 and slightly above the 1963-66 average of 18.4.

On Forbes 228 quail were harvested in 1966 from the expenditure of 640.5 gun-hours. The kill per gun-hour, 2.8, was 32 percent below the value for 1965. In 1966 on the Forbes Area, the kill per 100 acres, 10.3, was 124 percent greater than in 1965 and comparable to the 1963-1966 average of 9.3.

Assuming that the vulnerability of quail and the efficiency of hunters were relatively constant during the 1963-66 seasons, the hunting season data reflect an increase in the population in the fall of 1966. An increase in the prehunt populations on both the Dale and Forbes areas was indicated by the results of the 1966 prehunt census.

5. <u>Responses of Prairie Chickens to Habitat Manipulation</u> R. L. Westemeier

The nesting study on the Bogota Study Area in 1966 revealed that many wildlife species besides prairie chickens are being benefited by the sanctuaries. The period of nest searching extended from June 20 to July 21 on the 77-acre Yeatter and 20-acre McGraw sanctuaries. Besides the five prairie chicken nests on these acreages in 1966, there were 42 redwing blackbird nests, 19 meadowlark nests, 13 dove nests, 6 dickcissel nests, 4 upland plover nests, 1 quail nest, 2,001 vole (<u>Microtus</u> sp.) nests, and 8 bumblebee nests. Woodchucks and several nest predators such as snakes and striped skunks were also encountered during the nest searching activities.

These data provide a greater insight into the overall ecology of the sanctuaries. For example, the abundant vole population helps explain the large raptor concentration present on the study area during the spring of 1966. The raptor concentration in turn played a significant role in the abandonment of one booming ground as shown in a previous report (Monthly Wildlife Research Letter, July, 1966).

6. <u>Rabbit Management</u> J. A. Bailey, J. C. Hanson

One-hundred twenty-four cottontails were trapped and tagged on the Allerton Park 4-H Area during November 8th through 10th, 1966. In addition, 59 of these animals were marked by dyeing their tails yellow. On November 19th, Dr. H. H. Shoemaker and wildlife management students from the University of Illinois cooperated in the annual fall census of the 4-H Area. During coordinated drives of the study area, 351 observations of rabbits were made: 140 of color-marked animals and 211 of animals that were not color-marked. Using these data and the Petersen-Lincoln Index, it was estimated that the number of rabbits on the 4-H Area during early November, 1966 was 148 ± 19 (95 percent confidence limits).

Sixty rabbits were harvested from the 4-H Area during the period December 3, 1966, to January 8, 1967. Of these, 40 had been handled during the November trapping period. A second population estimate, calculated from this harvest data, indicates that there were 186 ± 34 cottontails (95 percent conficence limits) on the 4-H Area during November, 1966.

The population of cottontails on the 4-H Area during the fall of 1966 was higher than in any year since the population "crash" of 1962. However, the 1966 population was still below the average number of rabbits on this study area during autumn in the years 1956 through 1961.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | February, 1967 | Vol. 10, No. 2

1. Pheasant Populations and Land Use

S. L. Etter

The dispersal of pheasants from fall capture sites to wintering areas is apparently influenced by at least three factors: changes in cover conditions, accumulation of snow, and hunting. In an attempt to evaluate the effect of hunting on this dispersal, distances from the capture sites where tagged cocks were killed on opening day and during the following 8 days were compared. Because of the short period of time involved, cover changes were minimal, and in neither 1962 nor 1963, the 2 years in which sufficient numbers of cocks were killed to allow comparison, was there any snow during this period. Thus it appeared that any differences in movements could be attributed to hunting.

The movement data from 295 cocks were grouped in ½-mile intervals and the number of cocks in each category for each period were compared. A Chi-square test of these data indicated that significantly more of the cocks killed in the 8 days following opening day were killed at greater distances from the capture sites than were those killed on opening day. While these data do not indicate the relative importance of hunting in determining the winter distribution of pheasants, they strongly suggest that hunting does affect dispersal of pheasants independently of changes in cover conditions and snow accumulation.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

As prime pheasant nesting cover (hay and pasture) continues to decline on the Sibley Study Area, roadsides are becoming an increasingly important component of the nesting habitat complex. Of the 470 pheasant nests located on the 100, 10-acre study plots in 1962, 32 (7 percent) were on roadsides; in 1966, when only 101 nests were found on the plots, 27 (27 percent) were on roadsides. In 1962, only 8 percent of all successful nests (8 of 101) came from roadsides, compared with 24 percent (5 of 21) in 1966. Thus, although roadsides make up only about 1.5 percent of the study area, it seems reasonable to suggest that in the near future they will become the single most important nesting habitat.

In 1966, the success, in terms of pheasant production, per unit area of seeded roadsides on the study area was approximately three times that on "typical" unseeded roadsides. Thus, in the absence of hayfield and pasture cover, the seeding of roadsides could become a practical management tool which probably would substantially affect total production of pheasants on the study area.

3. Factors Influencing Distribution and Abundance of Pheasants

W. L. Anderson

Mean weights, in milligrams, of thyroid glands excised from hen pheasants collected in east-central Illinois during various periods in 1966 were: winter--

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52.5, prenesting--55.1, laying--45.8, incubating--48.7, brooding--55.6, and fall--49.9. Although there has been considerable disagreement regarding the proper interpretation of thyroid weights--their relation to thyroid activity (metabolic rate) - an illuminating critique of the subject has recently been published. It appears that within any species of birds the weight and volume of the thyroids are useful indices of thyroid activity, and that size is inversely correlated with activity. It also appears that, at least in passerine birds, weights and volume of thyroids decrease (increased activity) in autumn, winter, and early spring, and increase (decreased activity) during most of the spring, summer, and early autumn. The weight data for thyroids removed from pheasants superficially appear to disagree with these published findings. If, however, the laying and incubating periods are not considered, the seasonal changes in weights of the pheasant thyroids are similar to those of passerine birds; the thyroids from pheasants were heavier in spring (prenesting) and summer (brooding) than in fall and winter. Therefore, it is concluded that in pheasants the metabolic demands of egg production, and possibly of incubation, are of sufficient magnitude to increase thyroid activity to levels that exceed those characteristic of the colder (fall and winter) periods.

4. <u>Responses of Bobwhites to Habitat Manipulation</u> J. A. Ellis, K. P. Thomas

Since 1963 the sex ratio of quail during the fall on the Forbes and Dale areas has been determined by using data from the harvest, nightlighting, and baited traps. (The latter two methods were discontinued on Dale after 1964.) The sex ratio of juveniles on Forbes varied from 2.0 cocks per hen, using data from baited traps, to 1.2 cocks per hen, using harvest data, with a median ratio of 1.2 cocks per hen, obtained from nightlighting data in 1966.

Prior to 1966 the adult sex ratio has favored cocks, whereas the juvenile segment has contained more hens than cocks. In 1966 the adult sex ratio continued to favor cocks on both areas (Forbes, 1.2:1 and Dale, 2.2:1), but the juvenile sex ratio reversed to favor cocks (Forbes, 1.3:1 and Dale, 1.2:1). This reversal in the juvenile sex ratio has coincided with a concomitant increase in the fall populations.

5. <u>Responses of Prairie Chickens to Habitat Manipulation</u> R. L. Westemeier

Redtop grass (<u>Agrostis alba</u>) has long been recognized by some as an ideal type of nesting cover for prairie chickens in southern Illinois. For this reason redtop is used almost exclusively for the rapid establishment of nesting cover on the prairie chicken sanctuaries at Bogota. What has not been recognized is that there can be differences in the degree of use among various age-classes of redtop sod.

During the 4-year period, 1963-66, 33 prairie chicken nests have been found in a cumulative total of 517.6 acres of grassland dominated by redtop. This redtop acreage was categorized into five classes ranging from 1 to 4 years of age, with fields over 4 years of age considered as old sod. As expected, first-year sod ranked lowest, with only two nests found in 77 acres. The most striking difference existed between 45.5 acres of 2-year sod having 13 nests (28.6 nests per 100 acres) and 324 acres of old sod having 13 nests (4.0 nests per 100 acres).

The second-year sod had a nest density seven times greater than the old sod. Three-year sod ranked twice as high, and 4-year sod ranked slightly higher, than the old sod.

Most of these data have been collected from stands of redtop in close proximity to one another and to booming grounds. Thus, the possibility of bias due to selection by the chickens of one geographic location over another is minimal.

Admittedly, the older, thinner stands of redtop having a deep layer of duff on the ground are used by nesting prairie chickens. However, during the past 4 years at Bogota, the younger, more economically productive stands of redtop, especially those with an admixture of red clover and with only a light layer of dead vegetation on the ground, have had the highest nest densities. Thus, complete renovation-fertilizing, burning, mowing, or a recently developed technique involving sod-seeding -- may prove necessary to keep the sanctuaries in an attractive condition for nesting.

6. Rabbit Management

J. A. Bailey, J. C. Hanson

Information concerning the rate at which food passes through the digestive tract of the cottontail rabbit would be useful in studying the nutrition of this species. To provide this information, caged cottontails were force-fed gelatin capsules, each containing 17 colored glass beads about 2 mm in diameter. Most animals were force-fed more than once, each time with beads of a different color. The force-feedings occurred at 11 AM, 5 PM, 11 PM and 6 AM. Fecal pellets were collected and examined for glass beads at the next 9 AM and again at 9 AM on each succeeding day up to 10 days. Food was withheld from two groups of rabbits during the beginnings of these tests. The fasting period was from 6 AM until 9 AM of the following day. One group of animals was force-fed glass beads at the start of this fasting period; another was force-fed at 5 PM during the fasting period.

Some of the glass beads were passed in fecal pellets within 10 hours after ingestion. More than 90 percent of the beads had been passed by the fourth day after ingestion, regardless of the time of day at which they had been ingested. Ninety-nine percent of all the beads had been passed by the seventh day after ingestion, and no additional beads were passed on the eighth, ninth, or tenth day. The 27-hour fast delayed, by about 24 hours, passage of those glass beads passed during the first 3 days. However, even in the cases of fasted rabbits, more than ninety percent of the beads had been passed by the fourth day after ingestion; ninety-nine percent had been passed by the seventh day; and none were passed on the eighth, ninth, or tenth day after ingestion.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois March, 1967 Vol. 10, No. 3

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1. Pheasant Populations and Land Use S. L. Etter

For the past five hunting seasons the proportionate harvests of cock pheasants have been estimated from the return of tags from cocks marked during October and early November of each year. In an attempt to determine the degree of accuracy of this method, a comparison of the proportionate returns of tags from cocks tagged prior to and after October 21 was made for the years 1962 through 1964: because a different proportionate harvest was recorded in each of the 3 years, data for each year were treated separately. The data for 1963 revealed only a slight difference, not statistically significant. In 1962 and 1964, however, considerably smaller percentages of the cocks tagged prior to October 21 were bagged during the following hunting seasons than of those tagged after that date. Chi-square tests of the data for both years indicated significance at the 0.10 level but not at the 0.05 level.

While not conclusive, these data strongly suggest that a significant amount of mortality occurs during the October and November trapping period in at least some years. Taking this into consideration, it appears that in some years tag returns from juvenile cocks tagged during the entire October - November trapping period may underestimate the proportionate harvest of cocks actually alive at the beginning of the hunting season.

2. Manipulation of Pheasant Habitat G. B. Joselyn

Thirty-nine percent of the pheasant nests established on seeded roadsides (Sibley Study Area) in 1963 were successful, compared with 21 percent in 1964, 29 percent in 1965, and 23 percent in 1966. Success rates of nests established on managed control plots were 17, 13, 24, and 32 percent during 1963, 1964, 1965, and 1966, respectively. Thus, success of nests on managed control plots not only increased the last 2 years but was 9 percent higher than success of nests on seeded plots in 1966. However, because the number of nests established on seeded roadsides exceeded the number established on managed control plots, seeded roadsides still produced the greater number of successful nests.

The increase in the proportionate number of successful nests on managed control plots raises the question of the feasibility of attempting to improve the quality of nesting cover on roadsides solely by delaying mowing until late summer, which has been done since 1963. One explanation, as yet unsubstantiated, for the increased success rate on unseeded roadsides may lie in vegetative changes made possible by late mowing (increases in broad-leafed weeds, etc.). Presence of weeds and lack of uniformity in vegetation would make unseeded, late-mowed roadsides objectionable to most farm operators. It may be possible, however, to employ selective spraying techniques and fertilization to make roadside vegetation both relatively secure for nesting pheasants and acceptable to farm operators.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

It has long been wondered whether pheasants subsisting in marginal range can survive adverse environmental conditions as well as birds in Illinois' better range. Theoretically, pheasants from marginal range, which presumably are chronically stressed, would possess impaired abilities for coping with catastrophic conditions such as severe winter storms or lack of food. To test for possible differences in survival ability, five hens from marginal range (northern Coles County, Illinois) and five hens from the heart of the state's better range (Ford and Livingston counties) were captured during October 1966, and experimentally starved. All hens were juveniles (average age for both groups was 19 weeks), all were held individually in cages covered with nylon netting, and all had access to drinking water ad libitum. At the beginning of the experiment, the hens from marginal range weighed an average of 850 grams; those from the better range averaged 845 grams.

It was found that the hens from marginal range survived the applied stress (starvation) equally as well as the hens from the better range--both groups survived an average of 8.8 days. Survival of the former varied from 7 to 10 days, and that of the latter from 8 to 11 days. The birds from the respective ranges lost, on the average, 52 and 50 percent of their initial body weights before dying. The experiment was repeated in January 1967 and similar results were obtained; four juvenile hens from marginal range survived an average of 11.5 days, while three juvenile hens from the better range survived an average of 11.7 days. These findings tentatively suggest that pheasants, at least the juveniles, in marginal range can survive severe stresses as well as birds in the better range.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis, K. P. Thomas

In 1966, censuses of quail on the Dale and Forbes areas again yielded data which allowed the proportionate harvests of quail on those areas, by hunters, to be estimated using four different methods: (1) the ratio of marked to unmarked birds in the bag; (2) the harvest divided by the prehunt census estimate; (3) the difference between the prehunt and posthunt census estimates divided by the prehunt estimate; and (4) the harvest divided by the posthunt estimate and harvest, combined.

Estimates of the proportionate harvest ranged from 31 to 74 percent on Forbes; estimates for Dale were 63-64 percent. When the estimate of 31 percent obtained from method (1) above was disregarded, the other methods all indicated a 73-74 percent harvest on Forbes. Estimates obtained using method (1) are questionable because of bias due to sample sizes and differences in nonrandom distribution between marked quail and hunters over the Forbes area.

The estimates of the percentages of the prehunt populations of quail harvested during the past 4 years have remained relatively constant at 70 and 60 percent on the Forbes and Dale areas, respectively, with the exception of a 40-50 percent harvest on Forbes during 1963. Apparently, the population levels are fluctuating independently of the percentage of the fall populations harvested on these areas.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

Preliminary results in studies of grass culture on the Bogota Study Area indicate that grassland farming can be profitable and at the same time, perhaps, provide nesting cover for prairie chickens. A 1-acre plot of redtop and four ½-acre plots each of timothy, orchard grass, smooth brome, and mixed timothy-field brome were established on the 60-acre Donnelley Sanctuary during late summer, 1965. All plots were fertilized according to soil tests made by the Jasper County Farm Bureau, and seedbeds were carefully prepared.

Three weeks after the peak of hatching for prairie chickens in southern Illinois (about June 1) the four ½-acre plots were mowed; they yielded 275 bales of high-quality hay. At 50 cents per bale, gross income amounted to $68.75 per acre. In spite of the dry summer in 1966, regrowth on the hay plots appears to have been sufficient to provide medium-quality nesting cover in 1967. The plan in 1967 is to include a nitrogen application after mowing, thereby to improve regrowth of nesting cover for the subsequent year.

Most spectacular of the initial grass-culture studies was the 1-acre redtop plot which, when combined in late July, yielded 235 pounds of weed-free seed worth the top price of 35 cents per pound, or $82.25 per acre. Since there is little production cost involved in growing redtop, $82.25 per acre seems relatively competitive with corn or soybean farming.

Hopefully, as the overall acreage of the refuge system increases, larger experimental plots can be established. It is important to learn whether grasses managed in the strict economic sense can also provide high-quality nesting cover for prairie chickens. For example, 2-year-old stands of redtop having an admixture of red clover have had the highest nest densities during the past 4 years of nesting studies at Bogota. However, stem densities on the experimental redtop were about four times greater than on a typical stand of redtop. Conceivably, such thickness might be unacceptable to nesting hens and might hamper the movements of young chicks.

6. Rabbit Management — J. A. Bailey, J. C. Hanson

Habitat conditions at forms used for daytime resting cover by radio-tagged cottontail rabbits were observed during spring and autumn, 1965, and during summer and autumn, 1966. Cover preference was measured by the percent usage of habitat types available.

In the spring, 60 percent of the daytime resting forms were located in predominately grass cover, and 76 percent were found in grass during late autumn. However, during the summer months 39 percent of all forms were found in weedy forbs, and 24 percent were located in mixtures of weeds, grasses, and artifacts. Visibility around the forms decreased from 56 percent in April to 11 percent in June, and increased again to 72 percent in October. In spring and fall, an average of 58 percent of all forms observed were located in habitat with sparse overhead cover whereas, during the summer, 89 percent of the forms observed had dense, herbaceous overhead cover.

No significant evidence was found to show that cottontails selected one type of daytime resting cover over another. Rather, habitat at the forms seemed to coincide with the annual cycle of growth and death of the vegetation. Either the habitat is of little importance to cottontails in their selection of daytime resting cover, or the methods used in this study were not able to detect any selectivity.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois April, 1967 Vol. 10, No. 4

1. Pheasant Populations and Land Use S. L. Etter

During the years 1962-64, 396 hen pheasants (170 adults and 226 juveniles) marked during October and early November were observed during the following January-March periods while they were associated in winter groups. Of the adult hens observed, 130 (76 percent) had moved less than 1 mile from the fall capture sites, whereas only 20 (12 percent) had moved more than 2 miles. Of the juvenile hens observed, 142 (63 percent) had moved less than 1 mile, whereas 42 (19 percent) had joined winter groups more than 2 miles from the fall capture sites. These data indicate that juvenile hens are somewhat more mobile during the late fall and early winter than are adult hens.

In view of the above data and of the lower survival rate of juvenile hens, as compared with that of adult hens, during the October-February period (Monthly Wildlife Research Letter, March, 1966), it appears likely that social stress is increased in late fall when birds become concentrated in the small amount of cover remaining after the crop harvest, and that the juvenile hens are forced, in some instances, to accept marginal wintering conditions.

2. Manipulation of Pheasant Habitat G. B. Joselyn

The chemical defoliate Ortho Paraquat and the herbicide 2,4-D (ester) are being utilized on an experimental basis this spring and coming summer to determine the ability of these chemicals to modify "natural" (unseeded) roadside vegetation. A mile of roadside has been divided into 10 plots, each 130 yards in length, to which the chemicals are being applied, and one plot 440 yards long to serve as a control (no chemicals applied). Five of the 130-yard plots are being treated with Paraquat and the other five with 2,4-D. Spraying is being carried out on both sets of plots this spring and summer, according to five predetermined schedules with each chemical being applied on one plot: Plot 1, at 2-week intervals from April 15 through July 1; Plot 2, at 4-week intervals beginning April 15; Plot 3, on May 1 and June 1; Plot 4, on May 15 and June 15; and Plot 5, on May 15 only. Vegetative composition of the chemically treated and of the control plot will be compared to determine changes attributable to the chemicals.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

Current investigations of factors influencing the distribution and abundance of pheasants in Illinois are concerned primarily with measuring physiologic characteristics of pheasants from thriving populations located in Ford and Livingston counties. Pheasants are collected during all seasons of the year and are dissected to obtain weights of muscles, of fat deposits, and of internal organs.

At times, however, it has been possible to collect pheasants from marginal range (northern Coles County) and submarginal range (Neoga Release Area in Cumberland County), thus affording the opportunity for making quantitative comparisons of physiologic characteristics of pheasants from struggling populations with those of birds from thriving populations.

During October 1966 and January 1967, 23 hen pheasants were collected from thriving populations, 14 from marginal range, and 17 from submarginal range. These hens were classified as 4-month-old juveniles, 7-month-old juveniles, and adults (birds more than 12 months old). It was found that, of the physiologic characteristics measured, no dramatic, clear-cut differences existed between pheasants from thriving populations and pheasants from the marginal and submarginal ranges. There was, however, a tendency for muscles to be slightly smaller in birds from thriving populations, intermediate in birds from marginal range, and larger in birds from submarginal range. There was also a tendency for the pancreas to be of reduced size in pheasants from the marginal and submarginal ranges. Probably the most interesting finding was differences in mean weights of the thyroid glands, which were consistently 10 to 20 percent less in birds from submarginal range than in birds from thriving populations and from marginal range. This was true in both absolute weight and relative to body weight. As the thyroid glands regulate metabolic rate, and the size of these glands is inversely correlated with their rate of activity, this could be an important finding. It would appear that pheasants subsisting in submarginal range have, on the average, a higher metabolic rate than birds in the established range. If this finding is correct, it is possible that pheasants in submarginal range "burn themselves out" in a relatively short time, which would reduce their rate of survival.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, K. P. Thomas

Whistle count data collected on the Dale (1964-66) and Forbes (1965-66) areas indicated that annual fluctuations in the numbers of cock quail and of calls per stop were directly related to prehunt population densities. The average number of cocks and of calls, recorded per stop from mid-May to mid-July, multiplied by 5.9 and 1.4, respectively, would have yielded, with 99 percent confidence, the prehunt densities on the two areas. During 1966, for example, the average number of cocks per stop on Dale (4.5) was 2.1 times the value for Forbes (2.1); the prehunt density on Dale, expressed as bird per 100 acres (30.0), was 2.1 times the value for Forbes (14.0). For whistle counts to be valid indicators of fall populations on the two areas, we must assume that production and mortality during the summer months, per calling cock, were relatively constant on both areas during the 3 years of study.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

Counts of booming prairie chickens on the Bogota Study Area between January 10 and April 16, 1967, revealed a slightly increased number of cocks since the spring of 1966. The highest count of cocks, among 19 early-morning surveys in 1967, was 45, 10 percent higher than the peak count of 41 cocks in 1966. Between 1965 and 1966 the population level remained essentially unchanged. Between 1964

and 65 a decline of 35 percent was recorded and between 1963 and 1964 a decline of 17 percent, occurred. These data show that the 2 earlier years of moderate to drastic losses have been succeeded by 2 years of static or slightly increased breeding populations.

Also encouraging is that during the 1967 breeding period, booming activities were observed in 8 Sections (square miles) as compared with only 3 Sections in 1966. Most of the dispersion of birds in 1967 was in marked response to the newly available nesting habitat made possible through the efforts of (1) the Prairie Chicken Foundation of Illinois, (2) the Prairie Grouse Committee, Illinois Chapter-The Nature Conservancy, and (3) cooperative leasing arrangements between the Illinois Department of Conservation and local farmers.

Prairie chicken hens began appearing on the booming grounds on March 7, 1967 -- about 9 days earlier than in 1966 and also earlier than in any of the years 1963-65. The peak number of hens on the booming grounds was approximately 1 week earlier in 1967 (April 1) than in previous years, and the first successful copulation, as noted by observers in blinds on the booming grounds, occurred on March 25, somewhat earlier than in previous years.

6. Rabbit Management

J. A. Bailey, J. C. Hanson

Evidence for the occurrence of regionwide and synchronous fluctuations in the abundance of cottontail rabbits was available at least as early as 1928. However, very few states had obtained systematically collected data on the abundance of cottontails before 1945. Since 1950, many states have conducted annual censuses of the abundance of cottontails. These data were solicited and obtained from 10 states: Minnesota, Wisconsin, Michigan, New York, Iowa, Illinois, Indiana, Ohio, Missouri, and Kentucky.

A statistical analysis of the census data obtained from the 10 states has demonstrated the occurrence of regionwide and synchronous fluctuations in rabbit abundance during 1950 through 1965. During this period, cottontail-population indices were below average in 1951, 1952, and 1953, for every state that provided data. Contrariwise, nearly all of these states had above-average indices to cottontail abundance during 1956, 1957, and 1958; and again had below-average indices during 1961 through 1964.

Regionwide and synchronous fluctuations in the abundance of animals have been reported for other species, particularly those which are involved in the so-called 10-year cycle of game abundance in northern latitudes. The cause or causes of the 10-year cycle have not been detected, although its existence has been documented since 1911. It is therefore not surprising that the existence of regionwide, synchronous fluctuations in the abundance of cottontails is also unexplained.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois May, 1967 Vol. 10, No. 5

1. Pheasant Populations and Land Use S. L. Etter

The characteristics of the molt of the primary wing feathers have been used for some years to determine the ages of juvenile pheasants. Several workers have reported on the regularity of the molt and on growth of the primaries of pen-reared pheasants, but few data are available concerning the application of this technique to wild birds. During the years 1962-66, 35 wild juvenile pheasants (19 cocks, 16 hens) captured in late summer and early fall were subsequently recaptured later in the fall trapping period. Comparisons of the molt patterns, on each of the capture dates, indicated that these wild pheasants molted at a slightly faster rate, and that the growth rate of the 10th (outermost) primary was considerably faster, than those indicated for pen-reared birds. These differences, while marked, were quite consistent, and it appears that with modifications for the faster growth of the 10th primary, the molt of the primary feathers can be used as a reliable indicator of the age of wild Illinois pheasants up to 20 weeks of age.

2. Manipulation of Pheasant Habitat G. B. Joselyn

Roadsides constitute a relatively small proportion (about 1.3 percent) of the total land area in the prime pheasant range in east-central Illinois. Under a management plan which would establish seedings on roadsides over a large area, limited acreage might be the most important factor limiting the effect of seedings on population levels of pheasants. Roadsides on the 36-square-mile Sibley Study Area total approximately 350 acres. Discounting those roadsides with slopes too steep or too narrow to warrant seeding, and those for which permission to seed would be denied by farm operators, this total probably would be reduced to 150-200 acres.

The acreage of tame hay and pasture on the study area was estimated to be 2,850 acres in 1963, of which approximately 560 acres were unharvested hay; by 1966 the acreage of tame hay and pasture had been reduced to 1,462 acres, with only 135 acres unharvested. In 1963, tame hay and pastures accounted for nearly 54 percent of the successful nests on the 100, 10-acre plots, and in 1966, for 43 percent of the successful nests. A much higher population was present on the study area in 1963 than in 1966. Therefore, the effect of 150-200 acres of seeded roadsides on the pheasant population on the study area could have varied greatly between 1963 and 1966; it seems logical to assume that the impact would have been greatest in 1966. There is as yet no evidence that maintaining 150-200 acres of seeded roadsides on the study area would alone maintain an adequate huntable population, but it is realistic to suppose that such seedings would supplement production in other cover types.

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3. <u>Factors Influencing Distribution and Abundance of Pheasants</u> W. L. Anderson

Audio censuses of calling cocks, conducted during May, revealed that at least 44 breeding cock pheasants were present on the Neoga release area at the beginning of the 1967 nesting season. The 44 cocks found is 13 percent greater than the number found during May 1966 (39 cocks) and 175 percent greater than the all-time low (16 cocks), found during May 1964. The increase noted from 1966 to 1967 represents the third consecutive year that the population of breeding cocks has increased on the area. However, the number of breeding cocks present in 1967 was only 46 percent as great as the average number found during May of the years pheasants were experimentally released (1960 through 1963).

The persistency of the pheasants at Neoga offers continued encouragement that a low-density population of pheasants may eventually become established on this area. It seems reasonable to assume that the longer the population manages to subsist, the greater are the chances of developing a pheasant genetically adapted to the environmental conditions that prevail in southern portions of Illinois.

4. <u>Responses of Bobwhites to Habitat Manipulation</u> J. A. Ellis, K. P. Thomas

During each of the past 4 years (1963-66) the average size of quail coveys declined progressively through the prehunt (fall), posthunt (winter), and prebreeding (spring) censuses on both the Forbes (15.0, 9.3, and 8.7 for the 4-year averages) and Dale (16.1, 9.8, and 8.1) areas.

The average covey size for the prehunt population followed the same trend as population density on the two areas, declining until 1965 and rebounding in 1966.

Harassment during the hunting season apparently influenced the size of the coveys in the posthunt censuses. On the Forbes Area in 1964, 7.7 quail per covey were recorded after 1,074 gun-hours, whereas 12.2 quail per covey were observed the preceding year after 410 gun-hours.

Annual differences in covey size, as revealed by the posthunt censuses, were independent of population levels on the Forbes and Dale areas. The prebreeding covey sizes, however, were influenced apparently by factors which determined the preceding fall population levels. The prebreeding covey size remained low during 1963 (Forbes, 7.8; Dale, 5.7) and 1964 (Forbes, 8.3; Dale, 6.0), increased in 1965 (Forbes, 14.0; Dale, 14.8), and dropped in 1966 (Forbes 8.9; Dale 8.6); these fluctuations were inverse to fluctuations in population density the preceding falls.

5. <u>Responses of Prairie Chickens to Habitat Manipulation</u> R. L. Westemeier

During the spring period of late March to mid-April, 1967, 21 areas in 10 counties in south-central Illinois were systematically cruised in search of booming prairie chickens. At least three morning surveys were made in 8 of the 21 census areas and at least one morning survey, under good listening conditions, was made in each of the remaining 13 areas. All counts were made during the first hour of daylight.

A total of 179 booming cocks were found on 16 of the 21 areas surveyed.

Seventeen cocks were found on two areas added to the annual censusing effort this spring. On 19 areas which also were censused in 1966, 162 cocks were found in 1967, 11 percent less than the 182 cocks found on the same areas in 1966. Increased population levels since 1966 were recorded for four areas: (1) near Bogota in Jasper County, (2) near Farina and (3) Stephen A. Forbes State Park in Marion County, and (4) near Martinsville in Clark County. However, decreases were evident on 10 areas, and no change took place on 2 areas, 1 of which was the Hunt Area in Jasper County, where only one cock was found in both 1966 and 1967. No prairie chickens were found in the spring of 1967 on 5 of the 21 census areas, 3 of which were already defunct in 1966.

On 10 areas where censuses were initiated in 1963 there were 59 percent fewer prairie chickens observed in 1967 than were observed in 1963. Statewide population losses between 1963 and 1964, between 1964 and 1965, between 1965 and 1966, and between 1966 and 1967 were 16, 35, 34, and 11 on respective percentage bases. Although these data show a continuing downward trend, on a statewide basis, the most recent loss is of a lower magnitude than the three earlier declines. Since increased population levels were recorded on four census areas, it appears that the 1966 breeding season was relatively successful on some local areas in spite of limited acreages of nesting cover.

6. Rabbit Management

J. A. Bailey, J. C. Hanson

Autopsies of 167 cottontail rabbits collected during a 26-month period revealed that the left adrenal gland was heavier than the right in 165 of 167 cases. In one case the adrenals had equal weights and in one case the right adrenal was heavier.

Biologists studying stress in mammals frequently weigh adrenal glands, usually reporting total weights for pairs of glands. Since data may be wasted when an animal with one damaged adrenal is autopsied, it would be useful if the weight of the damaged adrenal could be predicted from the weight of its undamaged correlate. Accordingly, the weights of 167 pairs of adrenal glands were analyzed by linear regression procedures.

The 167 rabbits were either autopsied fresh or after they had been frozen. Adrenals were removed, cleaned of associated tissue, blotted on moist paper, and weighed. Average weight of the left adrenals was 109.6 mg; of the right adrenals, 83.9 mg. Regression formulae were as follows: Left adrenal = -1.9 + 1.33 times the weight of the right adrenal; right adrenal = 6.2 + 0.71 times the weight of the left adrenal.

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Mrs. Dodds

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | June, 1967 | Vol. 10, No. 6

1. Pheasant Populations and Land Use — S. L. Etter

The chronology of the hatching of pheasant nests on the Sibley Study Area has been determined for each year since 1962 from the progress of the molt of the primary wing feathers of juvenile pheasants captured by nightlighting during October and early November. These data indicate that 65.3, 57.4, 45.5, 53.8 and 64.3 percent of the chicks were hatched in May and June in 1962, 1963, 1964, 1965, and 1966, respectively.

Comparisons of these data with the relative success of the nesting seasons during these years (See Monthly Wildlife Research Letters, August 1964 and September 1966) indicate that the highest percentage of May- and June-hatched chicks occurred in 1962, when production was highest relative to the number of breeding hens, and was lowest in 1964, when production relative to the breeding population was lowest. These findings suggest that the success of the nesting season is strongly influenced by the proportion of the hatch which occurs in May and June.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

Several factors contribute to the willingness of farm operators to allow roadsides adjacent to their land to be seeded to grasses and legumes for nesting pheasants. These factors include an appearance compatible with the surrounding farmland, and few weeds. Another contributing factor could be whether insects destructive to adjacent field crops are attracted by the seedings, or, conversely, whether unmowed, seeded roadsides "hold" certain destructive insects out of adjacent fields, thus serving to reduce damage to crops over that which would occur where unseeded and mowed roadsides exist.

Beginning in June of this year (1967), entomologists of the Natural History Survey are making summer-long studies of insect populations on seeded, managed control, and unmanaged control roadside plots in an effort to detect any detrimental or beneficial effects of seeded roadside plots as regards damage to adjacent field crops.

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson

It has been recognized for many years that thriving populations of pheasants in Illinois, as well as in other midwestern states, are confined to the most recently glaciated soils--soils covered by the Wisconsin ice sheet. This observation gave rise to speculation that some plant growing on soils of recent glacial activity, or some substance, such as lime or gravel, present in these soils might be essential for the welfare and breeding vigor of exotic game birds. Early investigations indicated that a relationship existed between the availability of

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calcium and the abundance of pheasants in the eastern half of the United States. However, work conducted during the early 1960's revealed that calcium per se probably is not a major factor limiting the distribution and abundance of pheasants in Illinois.

Calcium is only one of a large number of inorganic ions commonly present in soil. Like calcium, many of these ions are essential for the existence and proper functioning of biological systems, and nearly all can become toxic when present in excess. Except for limited investigations of cobalt, magnesium, and phosphorus, the effects of these ions on pheasant populations have not been studied. Thus, the next phase in the elucidation of factors influencing the distribution and abundance of pheasants is obviously an investigation of the effects of as many inorganic ions as possible.

During October 1966 and January 1967, 23 hen pheasants were collected by nightlighting from thriving populations in Ford and Livingston counties, 14 from marginal range (northern Coles County), and 17 from submarginal range (Neoga release area in Cumberland County). The birds were classified as 4-month-old juveniles, 7-month-old juveniles, and adults (more than 12 months old). Twenty-two samples of various tissues and organs were excised from each of these hens, pooled (according to type of tissue, geographical region, and, when the samples were large enough, age), and sent to the Department of Physics, University of Tennessee, Knoxville, where they were analyzed for 5 major elements and 19 trace elements. Samples of food (from crops), grit (from gizzards), fecal material (from intestines), and soil (collected in the field) were also sent to Tennessee for analysis. Analyses of the major elements were made by flame photometric (calcium, magnesium, potassium, and sodium) and colorimetric (phosphorus) procedures. Concentrations of the trace elements (aluminum, boron, barium, beryllium, cobalt, chromium, copper, iron, lead, manganese, molybdenum, nickel, silver, strontium, tin, titanium, vanadium, zinc, and zirconium) were determined by emission spectrography.

Although the results of the analytical work are highly preliminary, some striking differences in ionic concentrations appear to exist among birds from the three regions. For instance, concentrations (ppm) in liver ash of 7-month-old juveniles from thriving populations versus birds of the same age from submarginal range were: barium, 34:7; cobalt, 18:7, titanium, 66:14; zirconium, 120:60; molybdenum, 18:59; and zinc 565:1,122. The completion of this study should cast considerable light on the problem of extending the range of the pheasant in Illinois.

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis, K. P. Thomas

Results of the prebreeding censuses conducted during mid-March 1967 indicated that the prebreeding quail population on the Dale Area was the highest ever recorded for the area. Ten coveys comprising 86 birds (7.8 quail per 100 acres) were located on Dale during the census. This estimate was 77 percent higher than the estimate for 1966 (4.4 quail per 100 acres).

The estimated prebreeding population on the Forbes Area in 1967 (107 birds; 4.8 quail per 100 acres) exceeded the estimates for all years except 1964 (117

birds; 5.3 quail per 100 acres), and was 179 percent higher than the estimate for 1966 (1.9 quail per 100 acres).

Preliminary trapping data from Forbes thus far indicate that there are three juvenile cocks per adult cock in the population. In 1966, six juvenile cocks were captured for every adult cock. Weather conditions during the past winter undoubtedly influenced survival of quail during this period; the winter was mild, with little snow.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

Two agencies, the Prairie Chicken Foundation of Illinois (PCFI) and the Prairie Grouse Committee of the Illinois Chapter of the Nature Conservancy (PGC) now own or lease a total of 494 acres in eight scattered sanctuaries on the Bogota Study Area -- close to the minimum goal of 500-600 acres believed necessary to maintain a self-contained flock of prairie chickens. Although only about two-thirds of the sanctuary acreage can currently (1967) be considered as potential nesting cover, essentially all of the refuge system will provide good nesting cover in 1968. Eighty acres of strategically located grassy nesting cover were also leased from private farmers in 1967 by the Illinois Department of Conservation to supplement the nesting habitat on the permanent sanctuaries. Furthermore, in 1966 the spring count of cocks on booming grounds at Bogota revealed that the previously declining population trend was halted, and in 1967 the spring count of booming cocks was 10 percent higher than in 1966. Thus, although the Bogota flock is still at a critically low level, the combination of newly available habitat and a population beginning to respond favorably offers encouragement that at least one flock of prairie chickens in Illinois will be saved from extinction.

Since one local prairie chicken area, such as the one near Bogota, might prove vulnerable in the future to such hazards as disease, weather disasters, or increased use of pesticides, at least one or two other areas should be considered as management areas. In a move to preserve a second flock of Illinois prairie chickens, a group of dedicated conservationists recently (April 1967) purchased a 160-acre farm near Kinmundy in Marion County. The plan is for the owners to lease the farm to the PGC now and donate it to the PGC sometime in the future. In addition to the new 160-acre sanctuary, 33 acres on nearby Stephen A. Forbes State Park, also in Marion County, were seeded to nesting cover in the fall of 1966. In 1967, 43 percent of the known statewide prairie chicken population was distributed along a 20-mile length of relatively contiguous prairie chicken range extending from Forbes State Park to southwestern Effingham County. This distribution is in direct contrast to the relatively isolated flock at Bogota, which contains 25 percent of the known statewide population and utilizes a relatively few square miles.

6. Rabbit Management — J. A. Bailey, J. C. Hanson

Success of hunters who visited the Sam Dale and Stephen A. Forbes State Parks specifically to hunt cottontail rabbits (and not bobwhite quail) has been recorded for the past four hunting seasons.

During the 1966-67 season, rabbit hunters made 361 trips and spent 1,114 hours harvesting 558 cottontails on the Sam Dale Park. These were the largest numbers of hunter-trips, hours hunted, and rabbits harvested during the past 4 years on the Dale Area; the popularity of this park as a place to hunt rabbits has increased each year since 1963. However, hunter-success at the Dale Area did not increase during the 1966-67 season as there were 1.5 rabbits harvested per hunter-trip (compared with 3.1, 1.8, and 2.0 during the previous three seasons) and 0.5 rabbit harvested per gun-hour (compared with 1.1, 0.4, and 0.6 during the previous three seasons).

During the 1966-67 season, rabbit hunters made 139 trips and spent 450 hours harvesting 142 cottontails on the Stephen A. Forbes Park. The numbers of hunter-trips and of hours hunted by rabbit-hunters on the Forbes Area have not increased steadily during the past 4 years, as they have on the Dale Area, perhaps because hunter-success has generally been higher at the latter park. Hunter-success at the Forbes Area during the 1966-67 hunting season was 1.0 rabbit harvested per trip (compared with 1.6, 1.7, and 1.4 during the previous three seasons) and 0.3 rabbit harvested per gun-hour (compared with 0.4, 0.5, and 0.4 during the previous three seasons).

The programs of habitat manipulation on the Dale and Forbes areas were altered during 1966. During the first hunting season following initiation of the new methods of habitat manipulation, success-rates of rabbit-hunters declined on both areas, continuing the general downward trends which have now been evident for 4 years.

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Mrs. Dodds

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois July, 1967 Vol. 10, No. 7

1. Pheasant Populations and Land Use S. L. Etter

During the years 1962-64, 1,354 cock pheasants were captured and marked (back-tagged and leg-banded) during October and November on the 36-square-mile Sibley Study Area. Of these marked cocks, 544 (40.2 percent) were shot during the following hunting seasons and their tags or bands returned. The return rate for cocks tagged in the 16 Sections in the middle of the study area was 41.4 percent, compared with 39.1 percent for cocks marked in the 20 Sections forming the borders of the study area. These differences were not significant as indicated by chi-square analysis.

The above data indicate that few if any cocks are shot far enough from the study area to reduce the probability of the return of their tags or bands. These findings lend confidence to the use of tag returns as indices of the proportionate harvests of cock pheasants.

2. Manipulation of Roadside Cover for Nesting Pheasants G. B. Joselyn

Northward movement of the alfalfa weevil (Hypera postica) may cause problems for existing and future roadside seedings, for use by nesting pheasants, which contain alfalfa. Survey entomologists expect the weevil to be causing economic damage in east-central Illinois within the next 2 years. Although the effect the weevil will have on roadside seedings in this section of the state is unknown, two possibilities are suggested by studies on this insect in other areas.

Alfalfa on roadsides where brome is dominant (usually the case with seedings over 2 years old) may (1) be completely eliminated over a period of 2-3 years or (2) be reduced but remain in sufficient quantities to be functional enough as a nitrogen-fixing agent to insure the vigor of the brome stand. Should the weevil eliminate the alfalfa, alternate legumes not affected by the insect will have to be tested for use in future seedings.

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3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

The body weight of 12 hen pheasants collected in Ford and Livingston counties during May 1967 averaged 1,075 grams. Examination of ovaries for the presence of ruptured follicles revealed that all of these hens had laid at least one egg, the average being 14.1. As a comparison, 13 laying hens collected in 1966 had laid an average of 12.3 eggs and weighed an average of 1,045 grams. Mean weights of selected tissues and organs excised from the hens collected in 1967, compared with those from the hens collected in 1966, were: sternal muscles, 99 percent as heavy; visceral fat, 133 percent; liver, 112 percent; and ovary, 142 percent. These findings indicate that hen pheasants in east-central Illinois were in better physical condition during initial phases of the 1967 nesting season than during the same period in 1966.

4. Responses of Bobwhites to Habitat Manipulation   J. A. Ellis, K. P. Thomas

Data on spatial relationships among quail coveys were analyzed for a 275-acre portion of the Dale Area for the prehunt, posthunt, and prebreeding censuses taken each year since the fall of 1963. This portion of the Dale Area was selected for the study of spatial relationships of quail coveys because (1) quail covey densities on this portion were high; (2) we were certain of the locations of nearest neighboring coveys; (3) this area was censused during the same day of each census. Also, the area has been intensively managed by the Division of Game, Illinois Department of Conservation, since 1962. R values (see Monthly Wildlife Research Letter, May, 1964) were calculated based on the locations of coveys found during each census.

Generally, quail coveys were randomly distributed on this portion of the Dale Area. R values ranged from 0.77, prehunt census in 1963, to 1.69, posthunt census in 1967. The latter R value, the only one of 12, departed significantly from random, indicating a distribution tending toward uniformity.

A direct correlation was found between the mean distance between nearest neighboring coveys ($\bar{r}_A$) and covey density ($r = 0.852$; df = 10; ref. $\underline{r} = 0.708$ at 0.01 level). However, no significant correlation was found between $\bar{r}$ and mean covey size.

From these data, we can postulate that the habitat used by quail in this area was randomly distributed, or that the habitat was uniformly distributed but utilized randomly by quail coveys. Random spacing also implies little intracovey competition for specific habitat types, or a lack of social stimuli that may affect covey distributions within populations, or both.

5. Responses of Prairie Chickens to Habitat Manipulation   R. L. Westemeier

It has been established mainly through reports from local farmers on the Bogota Study Area that prairie chicken nests are commonly destroyed by plowing during the spring nesting period, which extends from early April to early July. During the springs of 1964 and 1966, 16 and possibly 14 nests, respectively, were plowed under in wheat stubble or in wheat stubble-clover mixtures. For an endangered flock of prairie chickens such as the one at Bogota, numbering less than 100 birds (spring 1967), these rates of nest destruction are significant, since prairie chickens are believed to have only limited renesting capabilities. Also, many destroyed nests are probably not reported.

In an effort to minimize losses of nests by plowing, 145 acres of cover scheduled for plowing were searched with a tractor-mounted flushing bar during May 1967. All searched fields were in close proximity to booming grounds and several of the fields are known as traditional nesting sites. Fortunately, only one prairie chicken nest was found by use of the flushing bar. The nest was constructed of wheat straw; nearly equal proportions of red clover and timothy provided the surrounding cover. The hen, which flushed about 6 yards ahead of the flushing bar, on May 23, from a clutch of 10 eggs, later returned to complete her clutch (11 eggs), incubate, and hatch on June 18 -- following a leasing arrangement with the landowner to leave a block of cover unplowed around the nest

site. An electric fence was also built around the unplowed block of cover containing the nest, as a deterrent to predators.

Since only one nest was found by use of the flushing bar, it is hoped that the major proportion of the nests on the Bogota Study Area in 1967 were established on the nesting sanctuaries or in nesting cover leased from farmers by the Illinois Department of Conservation.

6. Rabbit Management

J. A. Bailey, J. C. Hanson

An analysis was made of the relationship between the weights and lengths of 499 cottontail rabbits captured during the periods of May through November in 1964, 1965, and 1966 on either the Allerton Park 4-H Area in Piatt County or the University of Illinois farms near Urbana. Female rabbits weighing more than 950 grams during the months of May through August were excluded from this sample to avoid distortion of the weight - length relationship by the weights of the products of pregnancy. All female rabbits included in the sample could not be designated, after palpation, as being pregnant.

Each animal was weighed to the nearest ounce and its length was measured to the nearest 0.5 cm by grasping the rabbit by the head and hind legs, extending it, and measuring from the tip of the nose to the tip of the hind feet. Weights were converted to grams, and lengths to decimeters, for analysis. The relationship between weight and length was analyzed by plotting the data and fitting curves with (1) three-point moving averages, (2) a multiple correlation with weight dependent upon the first, second, and third powers of length, and (3) a total correlation with weight dependent upon the third power of length.

Curves fitted to the data were similar. The multiple correlation coefficient was 0.976 for the cubic equation $W = 788.8 - 463.8\ (L) + 91.1(L^2) - 0.4(L^3)$, where W = weight (g) and L = length (dm). Likewise, the total correlation coefficient was 0.976 for the equation $W = 15.6 + 5.48\ (L^3)$, where W and L are again weight and length, respectively.

Since the correlation coefficients for these two equations are equal, the latter, more simple equation is preferred. Solving this equation for the regression coefficient and rounding off the dependent variable intercept produces the equation $5.48 = (W - 16)/L^3$, which can be used as an index to the physical condition of cottontails. For example, in the present sample of 499 rabbits, any animal with a condition index greater than 5.48 was heavier than average for its length class.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | August, 1967 | Vol. 10, No. 8

1. Pheasant Populations and Land Use — S. L. Etter

During the summers of 1962-64, 575 pheasant broods from 3 through 9 weeks of age were judged to be completely counted on the Sibley Study Area. The number of complete broods in each age-class varied from 52 at 9 weeks to 104 at 5 weeks. The mean brood sizes at 3 through 9 weeks of age were 5.1, 5.5, 5.8, 5.4, 4.8, 5.4 and 5.3 chicks, respectively. Too few broods younger than 3 weeks or older than 9 weeks were observed to determine mean brood sizes. These data fail to demonstrate any tendency for brood size to decline with increasing age. Thus it appears that chick mortality during this period (3 to 9 weeks) is slight.

The nesting studies conducted during the same 3 years, however, indicated that the mean number of chicks hatching in 183 successful nests was 8.8. These data indicate that chick mortality in excess of 3 chicks per brood occurs prior to the time the chicks reach 3 weeks of age. It appears, therefore, that the mortality rate of chicks is high shortly after hatching, but decreases rapidly with increasing age.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

Densities of pheasant nests in 1967 on seeded roadside plots (2.1 nests per acre) and on managed control roadside plots (1.6 nests per acre) represented the lowest establishment rates on both types of roadsides during any of the past 5 years. Rates of nest establishment on seeded roadsides have varied from a low (previous to this year) of 2.6 nests per acre in 1965 to a high of 3.8 nests per acre in 1964; on managed control plots, nest densities have decreased each year since 1963 (2.8 nests per acre), with establishment rates of 1.7 nests per acre occurring in both 1965 and 1966.

Over the 5-year period, 268 nests have been established on seeded roadsides (2.9 nests per acre), compared with 181 nests on managed control plots (2.0 nests per acre).

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson

Hen pheasants were collected during May and June 1967 in Ford and Livingston counties and were dissected to gain insight into the general physical condition and reproductive status of pheasants during the laying and incubating periods. Counts of ruptured follicles in ovaries of 12 laying hens suggested that the "average" hen began laying April 26 (range April 10-May 15). The estimated dates on which laying began were arrived at by allowing 1.3 days for each egg (ruptured follicle) laid. The number of ruptured follicles counted in ovaries of 12 incubating hens averaged 30.8, indicating that the "average" hen laid 31

eggs before beginning to incubate. As a comparison, the same techniques indicated that the "average" hen in 1966 began laying April 30 (range April 18-May 9) and laid 34 eggs before incubation began. These findings suggest that both the onset of laying and the number of eggs laid by hens in the state's better pheasant range were similar during the 2 years 1966 and 1967.

4. <u>Responses of Bobwhites to Habitat Manipulation</u> J. A. Ellis, K. P. Thomas

The juvenile/adult age ratios of cock quail collected by the cock-hen trapping method in 1967 were .84 and 1.11 for the Forbes and Dale areas, respectively. These ratios were lower than those determined for 1965 or 1966 and supported the viewpoint of a previous report (Monthly Wildlife Research Letter, Vol. 9, No. 8) that mild weather from January through March resulted in a decrease in the juvenile/adult age ratio of cocks.

The prehunt populations on Dale and Forbes increased from 1965 to 1966; the corresponding juvenile/adult age ratios of cocks, determined from the cock-hen trapping method, decreased from 1965 to 1966. If this pattern continues, we may expect the prehunt populations of 1967 to exceed the levels of 1965 and 1966.

5. <u>Responses of Prairie Chickens to Habitat Manipulation</u> R. L. Westemeier

As of August 20, 1967, 11 prairie chicken nests have been located on the Bogota Study Area. Five (45 percent) of these nests hatched, five nests were destroyed by predators, and one nest was destroyed by plowing. This year's predation rate on prairie chicken nests is the highest thus far recorded for the years 1963-67 at Bogota. Most, and perhaps all, of this summer's nest predation was believed due to striped skunks.

One apparent reason for the higher rate of predation on prairie chicken nests in 1967 may be the drastic decline since 1966 in the vole (<u>Microtus</u> sp.) population, which serves as a food supply for skunks and other predators. The 2,001 <u>Microtus</u> nests counted on the Yeatter and McGraw sanctuaries in 1966 represented a density of 23 nests per acre. In 1967 a density of only one nest per acre was found on these areas, representing a 96 percent decline since 1966. The scarcity of raptors at Bogota during the 1967 booming season and during the winter of 1966-67, as compared with an abundance of raptors 1 year earlier, provides further evidence of the current unavailability of voles as a food supply for predators.

6. <u>Rabbit Management</u> J. A. Bailey, J. C. Hanson

Production of soft food pellets (as opposed to hard fecal pellets) by caged adult cottontails on a diet of commercial rabbit food was measured during March 27-31 and June 20-23, 1967. All animals had been captive indoors in their 16- x 24- x 13-inch wire cages for at least 18 weeks before the tests began. Production of food pellets was measured for six rabbits during each period. However, three animals were involved in both tests. Thus, nine animals were involved in the 12 determinations of food-pellet production.

The animals were fitted with cardboard collars, 10 inches in diameter, which prohibited reingestion of soft pellets. Hard and soft pellets were collected from under the cages three times each day, beginning on the day after the collars had been fitted. Soft pellets were identified by their shape and their glutinous, textureless appearance. All pellets were dried at 65 C and weighed. Production of soft pellets was expressed as a percent of the total weight of both hard and soft pellets.

Averages of production of soft food pellets by six cottontails during March and June tests were 29.3 and 31.5 percent of total feces, respectively. Since these averages were not significantly different, data for the two tests were combined and the average production of food pellets for 12 determinations was 30.4 percent, with confidence limits between 26.2 and 34.6 percent ($P < 0.05$). In two similar studies with domestic rabbits (Oryctolagus cuniculus), it has been reported that 26.4 percent and 26.8 percent, respectively, of the total pellets were food pellets. These averages are within the confidence limits mentioned above for cottontails.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | September, 1967 | Vol. 10, No. 9

1. Pheasant Populations and Land Use — S. L. Etter

The standardized counts of pheasant broods, made on the Sibley Study Area during July and August 1967, revealed 4 percent more broods than were recorded in 1966 and 11 percent more than were recorded in 1965. One hundred twenty-seven broods were observed along 640 miles of roadside transect (two 40-mile routes were driven weekly), compared with 122 broods in 1966 and 114 broods in 1965. The average size of broods judged to be completely counted was 5.6 chicks, compared with 5.3 chicks in 1966, an increase of 6 percent.

The number of adult hen pheasants observed during July and August along these same 640 miles decreased from 242 in 1966 to 214 in 1967 (12 percent). Forty-one percent of the adult hens observed in 1967 were broodless, compared with 49 percent in 1966.

The above indices reveal a slight increase in production in 1967, compared with 1966.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

During 1967, the density of successful pheasant nests on both seeded and managed control roadsides was 0.5 per acre. This represents the lowest density of successful nests on seeded plots since the initiation of this investigation. Success rates on seeded plots in previous years were 1.1, 0.8, 0.8, and 0.7 nest per acre for 1963, 1964, 1965, and 1966, respectively; managed control plots had success rates, for the same years, of 0.5, 0.3, 0.4, and 0.6 nest per acre. Over the 5-year period, 71 nests have hatched on seeded roadsides (0.8 nest per acre), compared with 41 successful nests on managed control plots (0.4 nest per acre).

The low density of successful nests on seeded plots in 1967 is primarily a reflection of a substantially lower number of established nests than in previous years, whereas the number of nests established on managed control plots was only slightly lower than in previous years. The proportion of established nests that hatched on seeded plots was 39 percent in 1963, 21 percent in 1964, 29 percent in 1965, 23 percent in 1966, and 26 percent in 1967. On managed control roadsides, the proportion of established nests that hatched was 17 percent in 1963, 13 percent in 1964, 24 percent in 1965, 32 percent in 1966, and 23 percent in 1967.

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson

One phase of the investigations of possible effects of inorganic ions on the

distribution and abundance of pheasants is a study of the chemical composition of soil. Ten samples of soil were collected from each of three areas, one in good pheasant range (Ford and Livingston counties), another in fair range (northern Coles County), and the third in poor range (Neoga release area in Cumberland County). These samples were analyzed by the same procedures and for the same elements (excluding phosphorus) described in the report for June 1967 (Monthly Wildlife Research Letter 10(6):2-3).

When mean concentrations of the 23 elements for which analyses were conducted were subjected to a multiple range test, 14 exhibited statistically significant differences between at least two of the three areas. Mean values for good pheasant range were significantly greater than those for poor range for 10 elements--calcium (1,402:716 ppm), magnesium (1,945:1,253), potassium (1,213:477), chromium (73:33), copper (92:28), iron (47,367:29,493), molybdenum (2.4:1.4), nickel (65:33), titanium (4,783:2,430), and vanadium (30:4). Only one element (manganese) had a significantly lower mean concentration in soils from good pheasant range (333) than in soils from poor range (1,305).

These findings demonstrate that at least one constituent of the environment--chemistry of soil-- differs greatly between good pheasant range and poor range. Such differences could have profound effects on the distribution and abundance of pheasants in Illinois.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis, K. P. Thomas

Whistle counts on the Dale (1964-67) and Forbes (1965-67) areas were made to determine the relationship between fall population densities of quail and the numbers of whistling cocks and calls heard during the period of May 15-July 15 each year. Analysis of the data from the 1964-66 period showed significant regressions ($P < .01$) between numbers of whistling cocks or calls per stop and fall populations densities. These regression formulae were used to compute fall densities for 1967.

The numbers of calls per stop and of whistling cocks per stop during 1967 indicated high populations this fall on both areas. The average number of cocks per stop was 5.53 for Dale and 3.95 for Forbes. Using the regressions computed from 1964-66, the average number of cocks per stop indicated 32.2 quail per 100 acres for Dale and 23.1 quail per 100 acres on the Forbes Area. The number of calls per stop on Dale (28.3) and on Forbes (17.4) indicated that the fall populations would be 38.4 and 24.5 quail per 100 acres on the two areas, respectively. The predicted densities would be approximately 13 percent above the high population densities of 1964. We maintain, however, that whistle counts are valid indicators of fall populations provided summer mortality remains relatively constant.

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier

The effectiveness of the two oldest sanctuaries (Yeatter-77 acres, and McGraw-20 acres) for nesting prairie chickens on the Bogota Study Area has seriously

declined since 1963. In 1967, only two nests were found on each sanctuary and chick production amounted to only 21 young for the 97 acres. Thus, only 10.3 percent of the 39 nests and 8.9 percent of the 237 chicks produced on these tracts in the past five summers occurred in 1967.

The prairie chicken population at Bogota was 42.3 percent smaller in 1967 than in 1963. However, more hens have been seen on the two major booming grounds in the section containing the Yeatter and McGraw sanctuaries in the combined years of 1966 and 1967 than in 1963, 1964, and 1965 combined. For example, in 1966 and 1967, 15 and 8 individual hens, respectively, were observed on the booming ground on the Yeatter Sanctuary, yet only four and two nests, respectively, were found on this tract.

The declining use of the older sanctuaries may in part be due to dispersion of hens to newly created nesting cover. One case is the 60-acre Donnelley Sanctuary with its 2nd-year stand of redtop which contained three nests in 1967, two of which hatched and produced 25 chicks.

6. Rabbit Management — J. A. Bailey, J. C. Hanson

A method, using weight and a measure of body length, for evaluating the physical conditions of cottontails has been described (Monthly Wildlife Research Letter 10(7):3). This method provides condition indices which are used in comparing weights of rabbits from different length- and age-classes. Condition indices for rabbits captured during monthly trapping periods on the Allerton Park 4-H Area were used to evaluate trends in the physical conditions of cottontails during the periods of November through March in 1964-65 and 1965-66.

Average condition indices for rabbits on the 4-H Area increased during November through early January and declined during late January through February in both 1964-65 and 1965-66. In 1965, the average condition index continued to decline between February and March, whereas in 1966 the average index increased between February and March. These month-to-month trends in condition indices of rabbits in the 4-H Area accurately reflected month-to-month changes in the weights of rabbits that were captured in successive months on the area.

Loss of weight by cottontail rabbits during winter has been reported by biologists in Wisconsin, Michigan, and Illinois. Biologists in Illinois were unable to prevent these weight losses by providing the rabbits with supplemental food. The above reports and the present data suggest that weight losses during winter are normal among cottontails in northern latitudes. Since most rabbits on the 4-H Area gained weight during November through early January and lost weight thereafter, it could be that winter weight losses by cottontails are caused by normal physiological changes triggered by the change in photoperiod at the winter solstice.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | October, 1967 | Vol. 10, No. 10

1. Pheasant Populations and Land Use — S. L. Etter

The number of juvenile pheasants, of both sexes, per adult hen in fall has been used as an index of production on the Sibley Study Area since 1962. These indices have been obtained from the sex and age ratios of pheasants trapped by nightlighting during October and early November. An estimate of this index can be obtained by multiplying the percentage of adult hens with broods, observed along standardized roadside transects in August, times the mean number of chicks in broods judged to be completely counted. The calculated numbers of juveniles per adult hen were 5.2, 3.2, 3.1, 3.8, and 3.6 in 1962, 1963, 1964, 1965, and 1966, respectively. The ratios obtained from the trapped samples for the same years were 5.0, 3.4, 3.0, 2.9, and 3.8 juveniles per adult hen.

Using the calculated sex and age ratios as expected values, Chi-square analysis resulted in a significant difference only in 1965--apparently the result of small sample sizes for both the calculated and observed ratios. In view of the close agreement of the calculated and observed ratios in the other 4 years, it appears that adequate estimates of this index of pheasant production can be calculated for situations where the trapping of large numbers of pheasants is not feasible.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

It is desirable to compare pheasant nest establishment on seeded roadside plots with that occurring on "typical" unseeded roadsides on the study area. Because most farm operators usually mow roadsides several times each summer, managed control roadside plots (which remain unmowed until late summer) are not representative of other roadsides on the study area. Therefore, additional roadside segments on the study area were picked at random and searched for pheasant nests each summer from 1963 through 1967.

For the 5 years, pheasant nest density on seeded plots (2.9 nests per acre) was more than double the density of nests on all (mowed and unmowed combined) unmanaged control plots (1.3 nests per acre). Seeded plots had between 1.0 and 2.1 more nests per acre during each of the 5 years. Nest density on seeded plots was triple that on unmanaged plots which were mowed (1.0 nest per acre), but only about one-third higher than the density on unmanaged control roadsides which were unmowed (2.0 nests per acre).

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson

Research conducted by James A. Harper during the early 1960's indicated that grit is the principle source of calcium for pheasants. It was also learned that pheasants are capable of selecting grit rich in calcium in preference to grit poor in this element. But what about other minerals? Do they commonly occur in grit in concentrations great enough, or low enough, to influence the distribution and abundance of pheasants in Illinois?

To partially answer this question, grit from gizzards of 54 hen pheasants--23 from good pheasant range (Ford and Livingston counties), 14 from fair range (northern Coles County), and 17 from poor range (Neoga release area in Cumberland County)--was analyzed for 23 elements. The pheasants were collected by nightlighting during October 1966 and January 1967. After being washed in distilled water, the grit was pooled according to geographical region and age of the birds (4 months, 7 months, and adults); this produced eight composite samples (there were no 4-month-old birds from fair range). The analyses were conducted by the same procedures and for the same elements (excluding phosphorus) described in the report for June 1967 (Monthly Wildlife Research Letter 10(6):2-3).

The results of the analyses indicate that grit consumed by pheasants generally contains mediocre to low concentrations of many elements. Concentrations of five elements (chromium, copper, molybdenum, tin, and vanadium) were usually less than the limits of detection by the techniques employed. Six other elements (beryllium, lead, nickel, silver, zinc, and zirconium) seldom occurred in concentrations greater than 30 ppm. As a comparison, mean concentrations in soil from the three regions were below the limits of detection for only one element and less than 30 ppm for only four others. Only two elements (sodium and cobalt) were consistently more abundant in grit than in soil.

When comparisons were made among regions, seven elements were at least twice as concentrated (calcium, beryllium, iron, manganese, molybdenum, strontium, and vanadium), and only two were less than half as concentrated (aluminum and barium), in grit from poor pheasant range as in grit from good range. This is in direct contrast to concentrations of elements in soil from the two regions (Monthly Wildlife Research Letter 10(9):1-2, September 1967). The full meaning of these findings may not become apparent for several years.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, K. P. Thomas

One phase of the quail research conducted on the experimental management zone on the Forbes Area is to measure the vegetative changes effected by burning and cultivation. The management program for this zone stipulates that a fourth of the area in row crops be unharvested corn. In 1967, 7 of the 14 plots in this zone contained unharvested corn. Approximately half of the standing corn was seeded to tame legumes, white clover (*Trifolium repens*) and sweet clover (*Melilotus* spp.), in early April.

Vegetative analyses of the seeded and nonseeded portions of the standing corn were made during late July and early August. Vegetation was sampled with a 1/16-square-meter quadrat. A total of 142 quadrat samples were taken in the seeded portion, and 136 samples were taken in the nonseeded portion. Plant species were identified, and the percent top cover of each species present and percent bare ground were estimated.

Averages of 16 and 25 percent bare ground occurred in the seeded and nonseeded portions, respectively. The five most frequently occurring plant species in the seeded portion were: rough buttonweed (*Diodia teres*), *Trifolium repens*, goldenrod (*Solidago* spp.), tickle grass (*Agrostis hyemalis*), and Canadian St. John's-wort (*Hypericum canadense*). The five most frequently occurring plants in the nonseeded portion were: *Diodia teres*, *Solidago* spp., wild bean (*Strophostyles* spp.), *Agrostis hyemalis*, and foxtail (*Setaria* spp.). Thus, seeding the two clovers reduced the amount of bare ground, essential in good quail habitat, and replaced native legumes, *Strophostyles* spp., with a cultivated one, *Trifolium repens*..

5. Responses of Prairie Chickens to Habitat Manipulation   R. L. Westemeier

Since 1963, on the Bogota Study Area, 43 prairie chicken nests have been found in 704 acres of grassland dominated by redtop--a density of 6.1 nests per 100 acres. By categorizing this acreage into five classes ranging from 1 to 4 years of age, with fields over 4 years of age considered as old sod, respective densities of 2.0, 14.0, 8.3, 5.6, and 4.3 (nests per 100 acres) were revealed. Thus, 2nd-year redtop, with a density of 14.0 nests per 100 acres, has a density 3.3 times greater than the density for old sod. These data help explain the declining use of the Yeatter and McGraw sanctuaries by nesting prairie chickens, as described previously (Monthly Wildlife Research Letter 10(9):2-3). The nesting cover on these sanctuaries in 1967 was composed of redtop stands either 1 year or 5 or more years of age.

Another factor that appears to be important to nesting hens is proximity to field edge. Seventy-three percent of 40 nests found on the Yeatter, McGraw, and Donnelley sanctuaries since 1963 have been within 50 yards of the nearest field edge.

The oldest sanctuaries at Bogota have either been mowed annually for weed control or combined for redtop seed. Both practices result in buildups of vegetative duff on the ground. Apparently, prairie chickens find the excessive layers of residual cover undesirable for nesting and brood-rearing. More subtle ecological changes than buildup of duff may also be responsible for the declining use by nesting hens of progressively older stands of redtop. Therefore it seems prudent to use a variety of techniques to maintain the attractiveness of the sanctuaries to breeding prairie chickens. Such techniques might include using a variety of grasses and legumes initially and maintaining them by prescribed burning, midsummer mowing for hay, light grazing, plowing and reseeding, burning and sod-seeding, and perhaps using strips of cultivated crops to serve as edge and fire lanes.

6. Rabbit Management J. A. Bailey, J. C. Hanson

The numbers of cottontail rabbits captured in wooden box traps on the Allerton Park 4-H Area have always varied considerably among days within the 10-day trapping periods. Data from monthly trapping periods conducted during September through March in 1964-65 and 1965-66 were analyzed for correlations between trap success and weather factors. It was assumed that approximately the same number of rabbits was available to be trapped throughout each 10-day period and that deviations from the average number of rabbits captured per day during each trapping period could be related to weather factors. Trap success for each day was therefore expressed as a deviation from the appropriate trapping-period mean. Data on nine weather factors were obtained from records of the Illinois Water Survey, 25 miles from the study area. Linear correlation analysis was used to evaluate relationships between deviations in trap success and each weather factor.

Trap success was significantly correlated with high midnight barometer readings, little wind, and absence of precipitation, and tended to be higher during the cooler days of trapping periods than during the warmer days. High barometer readings, calm winds, clear skies, and cool temperatures are generally associated, and it is concluded that rabbits become more trappable during weather conditions which prevail within high-pressure air masses.

However, the utility of this conclusion is limited. An analysis of trap success, with midnight barometer reading, wind, occurrence of precipitation, and minimum temperature as independent variables, produced a multiple correlation coefficient of 0.355. The resulting coefficient of determination indicates that only 13 percent of the variation among numbers of rabbits captured has been associated with these four weather factors.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | November, 1967 | Vol. 10, No. 11

1. Pheasant Populations and Land Use

S. L. Etter

Pheasant hunting on the opening weekend of the season in 1967 was the poorest recorded on the Sibley Study Area in the last 6 years--hunters spent an average of 18.1 hours in the field to bag a cock pheasant. Comparable figures for 1962 through 1966 were 2.2, 2.7, 2.1, 8.0, and 6.9 hours, respectively.

The poor hunting this year was mainly the result of large acreages of standing corn. The corn harvest in east-central Illinois is about 5 weeks behind normal, and only about a fourth of the corn on the Sibley Study Area had been harvested when the hunting season opened. At the present rate of harvest, it appears that it will be early December before enough corn has been harvested to permit good hunting.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

For the 5 years 1963-67, pheasant nest density on seeded roadside plots was more than double the density of nests on all (mowed and unmowed combined) unmanaged control plots, which are considered "typical" unseeded roadsides on the study area.

Density of successful (hatched) nests on seeded plots for the 5 years (0.8 successful nest per acre) was double the density of successful nests on all unmanaged control plots (0.4 successful nest per acre). Seeded plots had between 0.5 and 1.1 successful nests per acre during each of the 5 years. Mowed unmanaged control plots produced between 0.4 and less than 0.1 successful nest per acre, each year, and 0.2 nest per acre for the 5 years; unmowed unmanaged control plots hatched from 0.4 to 1.1 nests per acre during the period and 0.6 nest per acre for all years combined. Thus, nest success on unmowed unmanaged control roadside plots for the 5 years compares favorably with that on seeded plots. This suggests that nonmowing of existing roadside vegetation could result in pheasant nesting cover which approaches the quality of seeded roadsides. While this supposition may prove valid, presence of weeds and lack of uniformity in vegetation on unmowed roadsides would make them unacceptable to most farm operators. It may be possible, however, to employ selective spraying techniques which would make roadside vegetation relatively secure for nesting pheasants and would also control undesirable vegetation sufficiently to eliminate objections from farm operators.

3. Factors Influencing Distribution and Abundance of Pheasants

W. L. Anderson

To gain further insight into the possible effects of inorganic ions on the distribution of pheasants, corn, the staple food of this species in Illinois, was

collected from agricultural fields and from crops of hens on three areas--good pheasant range (Ford and Livingston counties), fair range (northern Coles County), and poor range (Neoga release area in Cumberland County)--and chemically analyzed. The collections were made during October 1966 and January 1967. Corn from fields was collected at 12 locations on each area; corn from crops was removed from 16, 11, and 11 hens, respectively, from the three areas. The samples were pooled according to area and whether they were from fields or from pheasants. The analyses were conducted by the same procedures and for the same elements described in the report for June 1967 (Monthly Wildlife Research Letter 10(6):1-2).

Surprisingly, more differences were found between corn from fields and corn from pheasants (from the same area) than among corn (from either fields or pheasants) from the three areas. The percent ash of corn from fields was 1.33, 1.47, and 1.37, on a dry-weight basis, for good, fair, and poor pheasant range, respectively. As a comparison, corn from pheasants from the three areas was 1.70, 1.62, and 1.85 percent ash. Sodium was found to be strikingly more abundant in corn from pheasants (160, 128, and 208 ppm, on a dry-weight basis) than in corn from fields (1, 8, and 16 ppm). Calcium exhibited similar trends, being 137, 165, and 114 ppm in corn from pheasants but only 11, 51, and 25 ppm in corn from fields. Ten trace elements (aluminum, chromium, cobalt, iron, manganese, nickel, strontium, titanium, vanadium, and zirconium) were also consistently more abundant in corn from pheasants than in corn from fields. Only one element, molybdenum, was consistently more abundant in corn from fields (1.12, 0.27, and 0.45 ppm) than in corn from pheasants (0.05, 0.01, and 0.09 ppm). These findings tentatively suggest that not only pheasants in good range, but pheasants in fair and in poor range, also, are capable of selecting corn containing greater than average concentrations of minerals.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, K. P. Thomas

Nightlighting on the experimental management zone on the Forbes Area indicated significantly higher quail populations in this zone in 1967 than in 1966. Totals of 23.6 and 11.9 quail were observed per hour of nightlighting in 1967 and 1966, respectively. This difference was statistically significant (χ^2=30.9, $P < 0.005$).

Night-roosting cover in the experimental management zone in 1966 consisted of seven scattered, fallow plots of grasses and weeds; the sod age was at least 3 years. In 1967, roosting cover consisted of seven scattered plots containing small-grain stubble. Wheat and oat stubble has been recognized as prime quail-roosting cover. Burning, and reestablishment of small grains, will be used to maintain adequate roosting cover in the experimental management zone on Forbes.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

Some indications of reproductive success and phenology of prairie chickens in 1967 were provided by limited data collected on nests and broods on the Bogota Study

Area. Forty-six percent of the 13 nests located at Bogota in 1967 hatched. In the past five summers, 1963-67, hatch success has averaged 41 percent (based on 99 nests of known fate). Thus, hatch success was slightly above average in 1967. Only one nest was known to have been destroyed by plowing in 1967, but the 46 percent loss of nests due to predation was the highest since 1963.

The average number of eggs in nine completed clutches in 1967 was 11.3. An average of 10.4 eggs per completed clutch was calculated for 56 clutches for the period 1963-67. Respective fertility and hatchability levels amounted to 94.5 percent and 93.2 percent for 73 eggs in six clutches at Bogota in 1967. The average hatchability level for 372 eggs in 35 clutches during the period 1963-67 was 95.7 percent.

Seventeen dates of hatch were established from data on seven nests and from age estimates for 10 prairie chicken broods. The dates of hatching in 1967 extended from May 18 to July 1, with 50 percent of hatching completed by June 1. Midpoints of hatching in 1966, 1964, and 1963 were estimated to be June 7, May 27, and June 2, respectively.

The average size of five broods observed in 1967 (three in Jasper County and two in Marion County) was 7.6 chicks. Complete counts of brood size were too limited in 1967 to support inferences about the gradual attrition of brood size. One of possibly three individual broods seen on the newly acquired 160-acre sanctuary in Marion County contained 11 young prairie chickens approximately 8 weeks of age.

6. Rabbit Management

J. A. Bailey, J. C. Hanson

Success in capturing cottontails during September through March on the Allerton Park 4-H Area has been positively correlated with weather conditions which prevail within high-pressure air masses (Monthly Wildlife Research Letter 10(10):4). However, with respect to weather, the trap responses of adult male rabbits were conspicuously different from those of five other sex-age classes. Whereas other rabbits became more trappable during cool periods with high atmospheric pressure, little wind, and no precipitation, the trappability of adult males was not correlated with wind, showed a positive correlation with the occurrence of precipitation ($r = 0.25$, $P < 0.01$), and appeared to be associated with low midnight barometer readings and warm weather. When success in trapping adult males was analyzed by multiple regression, with midnight barometer reading, wind, occurrence of precipitation, and minimum temperature as independent variables, only one partial regression coefficient was significant. Significantly more adult males were captured when precipitation occurred during trapping ($P<0.01$) than when precipitation did not occur.

Behavioral factors influencing the probability that a cottontail will enter a box trap have not been determined. Susceptibility to trapping could be influenced by size of home range, amount of movement, wariness, curiosity, an inclination to seek shelter, or previous experience with traps. The roles of these and other factors in determining trappability could vary with weather. Since we do not know why rabbits enter traps, we cannot explain why the trap responses of adult male cottontails on the 4-H Area have, with respect to weather, been diametrically opposed to responses of the other sex-age classes.

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Monthly Wildlife Research Letter

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schulz, Editors

NATURAL HISTORY SURVEY
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Urbana, Illinois | December, 1967 | Vol. 10, No. 12

1. Pheasant Populations and Lane Use — S. L. Etter

During October and early November of the years 1962-65, 1,438 juvenile hen pheasants were captured and marked with numbered plastic back tags on the Sibley Study Area. The ages of these juvenile hens were determined to the nearest week from the progress of the molt of the primary wing feathers. The indicated ages were then used to backdate to the weeks of hatch.

Of these fall-tagged juvenile hens, 386 (26.8 percent) were observed alive after January 1 following capture. The observation rate for juvenile hens hatched in June (32.1 percent) was considerably higher than that for juvenile hens hatched in July (23.5 percent). Chi-square analysis indicated that this difference was significant ($\underline{P}<0.025$).

Since trapping was done over a relatively short period of time, it was recognized that in determining observation rates, the effect of chronology of hatch was not independent of the effect of tagging juveniles of different ages. Consequently, the observation rates of hens hatched in June and July which were tagged at the same ages (14-18 weeks) were compared. This comparison indicated that the observation rate of juvenile hens hatched in June was significantly higher ($\underline{P}<0.025$) than that of hens hatched in July, and confirmed the assumption that the differences in observation rates were largely the result of chronology of hatch.

Although observation rates are only indices of survival, it is apparent that juvenile pheasants hatched in June survive considerably better than those hatching later in the nesting season. These data suggest that survival rates of juvenile pheasants during late fall and early winter may fluctuate from year to year according to the chronology of hatch during the preceding nesting season.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

Five years of data show that secondary roadsides seeded to a grass-legume mixture produced twice as many successful pheasant nests (density per acre) as unseeded control roadsides. However, since only about 11 miles of roadsides were involved in the original seedings, it cannot be assumed that seeding of roadsides constitutes a practical means of managing pheasant nesting cover throughout a large area in Illinois. To determine the feasibility of establishing seedings over a sizable area, plans are being made to seed roadsides in and abutting on a 16-square-mile area in Ford County (Ford County Management Unit); the area contains 80 miles (approximately 160 acres) of secondary roads, and 100 farm units.

It is hoped that this undertaking will provide answers to questions regarding (1) the acceptance of seedings by farm operators and owners; (2) the problems of establishing a large number of seedings, from the standpoint of equipment operation; (3) the cost and time required to establish and maintain sedings; and (4) the possible effects of such seedings on pheasant population levels in future years.

Personnel of the Natural History Survey have undertaken initial planning of the operation, such as designating roadsides to be seeded and computing the acreages involved. Department of Conservation personnel will contact landowners and establish the seedings. Planting will be done during August 1968. Comparisons of pheasant population levels on the Ford County Management Unit with those on a nearby control area began during the spring and summer of 1967 and will continue during 1968 and following years, when the seedings mature as pheasant nesting cover.

3. <u>Factors Influencing Distribution and Abundance of Pheasants</u> W. L. Anderson

In the previous report (Monthly Wildlife Research Letter 10(11):1-2), it was shown that corn from crops of pheasants contained concentrations of minerals that were higher than average for this grain. It was therefore concluded that pheasants might be capable of selecting corn rich in minerals in preference to corn poor in these inorganic nutrients. An alternate, but seemingly less logical, interpretation of this finding was that organic nutrients were withdrawn from the corn while it was in the crops, thereby increasing the mineral components of the grain relative to the organic components. Accounts in the published literature indicated that the crop plays a minor role in digestion and absorption. Further, corn, which has a hard seed coat, might be expected to be especially resistant to digestive activity unless it was masticated. Nevertheless, it is difficult to universally apply a biological rule to all species of birds under all environmental conditions.

To determine whether appreciable amounts of organic nutrients are withdrawn from corn while it is in crops, two captive pheasants, both adult hens, were force-fed about 25 grams each of whole-kernel corn on the evening of December 13. The following morning, 15 hours after feedings, the birds were sacrificed; the corn remaining in their crops was removed, washed, and placed in an oven (59 C) to dry. Two control samples--corn that had not been fed to pheasants--were also washed and dried. Dry weights of corn from the crops (256 and 263 mg per kernel) were found to be similar to those of the controls (257 and 268 mg per kernel). Thus, the possibility that significant amounts of organic nutrients are withdrawn from the corn while it is in crops of pheasants was rejected, thereby strengthening the interpretation that pheasants might be capable of selecting corn containing greater than average concentrations of minerals.

4. <u>Responses of Bobwhites to Habitat Manipulation</u> J. A. Ellis, K. P. Thomas

Estimates of the prehunt quail populations on the Dale and Forbes areas in 1967 were 514 quail (22.3 per 100 acres) on Forbes and 400 quail (36.4 per 100 acres) on Dale. These prehunt population levels were higher than those of similar periods since 1963. The prehunt population of 1967 exceeded that of 1966 by 64 percent on Forbes and by 22 percent on Dale. Two factors were believed responsible for the high populations of quail during the fall of 1967. The mild winter of 1966-67 afforded good survival of birds to the breeding season (Monthly Wildlife Research Letter 10(6):2-3). Also, quail were captured this fall that were hatched the first

week of October, which indicated a prolonged nesting season.

The high prehunt populations on the areas in 1967 resulted from increases in the numbers of fall coveys, with slight increases in mean covey sizes. In 1966, 20 coveys were located on Dale, with 16.4 birds per covey; and 19 coveys were found on Forbes, with 16.5 birds per covey. In 1967, 23 coveys on Dale averaged 17.3 birds per covey, and 31 coveys on Forbes averaged 16.6 birds per covey.

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier

The annual search for prairie chicken nests on the Bogota Study Area has usually been conducted after the main period of hatch. Thus, physical characteristics of nest sites, such as height of cover, are noted at a time when cover height maybe of minimal importance to nesting hens. Because prairie chickens nest relatively early and have only limited renesting capabilities, residual vegetation from the preceding growing season is vitally important as nest material. The height of cover at the period of nest initiation can therefore be estimated during early April by noting the height of residual vegetation in fields scheduled for searching later in the summer. Cover height is defined as the prominent horizontal plane formed by the tops of vegetation when viewed at a low angle.

The mean height of the cover at the sites of 60 prairie chicken nests was 22 ± 10 (SD) inches with a range of 7 to 48 inches at the time the nests were found during the period 1963-67 at Bogota. At the period of nest initiation (early April), however, the mean height of cover for a sample of 31 nests was only 11 ± 5 (SD) inches with a range of 3 to 24 inches.

Redtop fields combined to a height of 10 to 16 inches have been the primary cover type available for nesting on the Bogota Study Area in recent years. Thus, nesting hens readily accept relatively short cover in which to establish their nests, but this does not preclude the possibility that taller, undisturbed stands of grass are not also acceptable for nesting.

6. Rabbit Management J. A. Bailey, J. C. Hanson

Trapping of cottontails on the Allerton Park 4-H Area during October and November, 1967, resulted in the color-marking of 76 rabbits. On November 18, Dr. H. H. Shoemaker and wildlife management students of the University of Illinois cooperated in the annual autumn census. Compared with numbers of rabbits seen in previous years, few rabbits were seen during this year's coordinated drives of the 120-acre study area. There were 145 observations of rabbits, 94 of marked animals and 51 of unmarked animals. It was therefore estimated that 65 percent of the population had been color-marked.

Using the Petersen-Lincoln Index, the estimated number of rabbits on the 4-H Area during mid-October, 1967, was 117 ± 14. During 1956-61, estimates of the numbers of cottontails on the 4-H Area during autumn ranged between 2 and 3 rabbits per acre. However, the population declined abruptly in 1962 and autumn population estimates have varied between 0.8 and 1.5 rabbits per acre during 1962-67. This decline has, at least in part, been due to deteriorating habitat conditions caused by plant succession and a tree-planting program.

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MONTHLY WILDLIFE RESEARCH LETTER

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Urbana, Illinois | January, 1968 | Vol. 11, No. 1

1. Pheasant Populations and Land Use — S. L. Etter

During October and November of the years 1962-64, 1,239 juvenile cock pheasants were captured and tagged on the Sibley Study Area. The ages of these juvenile cocks were determined to the nearest week from the progress of the molt of the primary wing feathers. The indicated ages were used to backdate to the weeks of hatch.

Of these fall-tagged juvenile cocks, 495 (40.0 percent) were shot during the hunting seasons following capture. The harvest rates for cocks hatched in late May and June (43.5 percent) and in July (40.5 percent) were nearly equal and did not differ statistically. The harvest rate for cocks hatched in August (23.9 percent) was considerably lower than those for cocks hatched earlier in the nesting season.

The lower harvest rate for late-hatched cocks may be partially the result of the inability of hunters to distinguish young cocks with incomplete first-winter plumage from hens. A second possible cause for their lower harvest rate is that fewer of the late-hatched cocks, compared with cocks hatched earlier, survive from the time of trapping to the hunting season.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

During the summer of 1967 the 80 miles of roadside on the Ford County Management Unit were examined to determine their acreage and their potential for seeding to pheasant nesting cover. Roadsides ranged in width from 8 to 25 feet. Approximately 61.2 of the 80 miles were designated for complete seeding (road edge to fence line). Eight miles were designated for partial seeding (either foreslope or backslope only). Ten miles were found to consist of good stands of brome grass (Bromus spp.) and thus will not be seeded. Three-quarters of a mile of roadside were eliminated from consideration because steep drainage ditches abutted on the road, which would make it impossible for planting machinery to operate. A total of 150.7 acres are designated for seeding.

Lists of farm operators within the area of the management unit were compiled and are now in the hands of Department of Conservation biologists; the farm operators will be contacted during February for permission to undertake the seedings during August. Farmers will be requested not to mow seeded roadsides (as well as those left unseeded because of existing adequate pheasant nesting cover) until on or after July 31. The management unit includes 65 farm operators: 16 landowners, 46 tenants, and 3 both tenants and owners.

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson

In an earlier communiqué (Monthly Wildlife Research Letter 10(10):2), it was

reported that grit consumed by pheasants generally contains mediocre to low concentrations of many elements. This conclusion was based on results of chemical analyses of grit removed from gizzards of hen pheasants collected in good, fair, and poor pheasant range during October 1966 and January 1967. Recent analyses of grit removed from samples of soil, also collected in good, fair, and poor pheasant range, necessitates modification of this conclusion. Ten ions (calcium, magnesium, potassium, chromium, copper, lead, manganese, molybdenum, zinc, and zirconium) were usually more than twice as concentrated in grit from soil than in grit from gizzards. Only four ions (boron, silver, strontium, and titanium) were less than half as abundant in soil grit as in gizzard grit.

These differences are presumably a manifestation of digestive activity in the gizzard, with some ions or groups of ions being removed from the grit at a more rapid rate than others. Investigators in Missouri have demonstrated that calcareous grit fed to laying and postbreeding pheasants is reduced by 85-95 percent within 36 hours following ingestions. On the basis of this finding, these workers indicated that concentrations of calcium [and presumably other elements] in grit from gizzards may be poor indices of the calcium [and other minerals] content of grit injested by pheasants. Results of the present study support this inference.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis, K. P. Thomas

Harvest of quail on the Forbes and Dale areas has ranged from 100 quail (Forbes, 1965) to 253 (Forbes, 1964) for the period 1963-66. Prehunt populations have fluctuated from 203 on Dale in 1965 to 514 on Forbes in 1967. Despite these fluctuations in population levels and kills, the percentage of quail harvested each year was not significantly different from the mean of 62 percent for the 1963-66 period. No significant correlation was found between the percentage harvest of quail for a particular year and the prehunt population the following year (t = 1.15, df = 6, ref.05 = 2.45). These data indicate that population fluctuations do not directly reflect harvest, although an extremely high percentage of the quail on the two areas has been removed annually. Because prehunt population levels in 1967 exceeded previous prehunt populations on the two areas, the quail populations thus far appear to tolerate the previous amplitude of harvest.

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier

The soils of the remnant prairie chicken range in Illinois are typically silt loams on tight clay subsoils which are slowly permeable and remain cold and wet until relatively late in the nesting season. Therefore, local drainage features are important factors in the selection of nest sites by prairie chicken hens. Eighty-six percent of 21 nests found on the Bogota Study Area in 1966 and 1967 were within a few yards of dead furrows, waterways, or roadside ditches, which provided good drainage for the nest sites.

Also, at Bogota 82 percent of 68 nests found during 1963-67 were on west- or south-facing slopes--both of which tend to be warmer and drier than east- or north-facing slopes. However, 57 percent of the 68 nests were on the Yeatter and McGraw sanctuaries, which slope west and south, respectively, and have had the best available nesting cover during the 5-year period. North and east slopes are now available to nesting hens on some of the newer sanctuaries, which should provide

an opportunity to learn whether west and south slopes are actually preferred. Forty-six nests have been found at Bogota in undisturbed cover. All were exposed overhead in varying degree. While 17 percent of the nests had no obvious lateral opening, 61 percent were exposed to the northeast, east, southeast, or south (180°) directions. Thus, there appears to be some tendency for nesting prairie chickens to orient their nest entry to take advantage of morning sunlight.

6. Rabbit Management J. A. Bailey, J. C. Hanson

Evidence for the occurrences of a regionwide scarcity of cottontails during 1952-53, a regionwide abundance during 1955-58, and another regionwide scarcity during 1961-64 has been presented (Monthly Wildlife Research Letter 10(4):3). These data have also been used to examine the geographic pattern of events in the regionwide increases and decreases in abundance of cottontails.

The change from scarcity to abundance of rabbits in Minnesota, Iowa, Indiana, and Missouri during 1950-59 was examined. In data from these states: (1) the lowest population index during 1950-59 occurred first in Minnesota (1951) and last in Missouri (1954); (2) the first index above the 1950-59 average index occurred first in Minnesota (1954) and last in Missouri (1956); and (3) the highest index during 1950-59 occurred first in Minnesota (1955), next in Indiana and Missouri (1956), and last in Iowa (1958).

The change from abundance to scarcity of rabbits in Minnesota, Wisconsin, Michigan, New York, Illinois, Indiana, Missouri, Kentucky, Tennessee, and Alabama during 1955-63 was also examined. In these data the highest population index occurred first in Minnesota and Michigan (1955); then in New York, Indiana, and Missouri (1956); then in Wisconsin, Illinois, and Kentucky (1957); next in Tennessee (1959); and last in Alabama (1960). Also, the largest 1-year decline after 1955 occurred first in New York (1957); second in Illinois (1958); then in Minnesota. Wisconsin, and Michigan (1959); next in Indiana, Missouri, and Kentucky (1960); then in Tennessee (1962); and last in Alabama (1963). The first index, after the highest index since 1955, that was below the 1956-65 average occurred first in Kentucky (1958); second in Minnesota, Wisconsin, Michigan, and New York (1959); third in Illinois, Indiana, and Missouri (1960); then in Tennessee (1962); and last in Alabama (1963).

While the pattern in these data is not perfect, they suggest a north-to-south progression of events in the regionwide fluctuations in cottontail abundance that occurred in the eastern United States during 1950-65.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | February, 1968 | Vol. 11, No. 2

1. Pheasant Populations and Land Use — S. L. Etter

In order to evaluate the response of hunters to the 2-week extension of the pheasant hunting season in 1967, questionnaires were sent to 48 hunters who had returned tags or bands from cocks killed during the last four hunting seasons. The hunters were asked to indicate the number of times they hunted during the regular season in 1967 and during the 2-week extended period, and also to indicate the number of cocks they killed during each period.

The 30 hunters who responded to the questionnaires reported a total of 116 days of hunting during the regular season and a total of 61 days during the extended period. The reported kills were 107 cocks and 61 cocks during the regular season and the extended period, respectively. According to these data, the hunting effort increased 53 percent and the kill increased 57 percent over that which would have occurred without the season extension.

In spite of the increased kill resulting from the extension of the hunting season, the total kill of cocks was considerably lower than in 1965 or 1966. The sex ratio of pheasants on the Sibley Study Area after the 1967 hunting season was 59 cocks per 100 hens, compared with 40 and 33 in 1965 and 1966, respectively. These data indicate that despite the fact that the extension of the season was successful in providing considerable additional hunting, a large number of harvestable cocks remained in the field after the season ended.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

The method used to establish roadside seedings in 1962 (plowing, disking, and harrowing, followed by hand seeding) was reliable, but too costly and time consuming to be considered practical for establishing seedings over a large area. During the past 3 years, approaches investigated as possible one-step methods of establishing grasses and legumes in bluegrass sod include: (1) using a sod seeder to seed directly into sod, without tillage; (2) complete tillage (to provide a prepared seedbed as in plowing) using a high-speed rototiller with an attached broadcast seeder; and (3) complete tillage using a large, slow-speed rototiller.

None of these methods proved entirely satisfactory. The sod seeder, being constructed for operation on level ground, failed to function properly because of the undulations in most roadsides. The large, field-type rototiller worked well but, because of its size and the large tractor required to pull it, proved undesirable for use on small roadsides. The high-speed rototiller was small

enough but too fragile for roadside work in sod.

The Howard Rotavator company has recently placed on the market a "Rotaseeder," which is a 70-inch rototiller fitted with special slot-cutting blades and a seed drill. This machine can be pulled by a relatively small tractor, seeds a 6-foot strip, and appears rugged enough for roadside work. Last August, one of these machines was tried on several miles of roadsides on and near the Sibley Study Area. It was generally concluded that this machine was the best available for roadside work at the present time. The Department of Conservation has purchased a Rotaseeder for use in seeding roadsides on the Ford County Management Unit during August 1968. During the winter, an extra seedbox is being added to the Rotaseeder to allow brome and alfalfa to be seeded at the same time.

3. Factors Influencing Distribution and Abundance of Pheasants   W. L. Anderson

It is generally believed that wild pheasants obtain the bulk of the calcium they need from grit. Findings of recent studies designed to determine the possible effects of 24 inorganic ions on the distribution of pheasants in Illinois tend to support this contention. Calcium, as well as magnesium and sodium, was more abundant in grit than in soil or in foods commonly eaten by pheasants. However, soybeans--and not grit--contained the highest concentrations of potassium. Trace elements were, for the most part, most abundant in soil; notable exceptions were cobalt, copper, and manganese, all of which were most abundant in grit. Thus, soil and grit appear to be the richest sources of most minerals directly available to pheasants.

However, a few words of caution are in order. Although a substance such as grit or soil is rich in ions, it does not necessarily follow that this substance is a major source of minerals for pheasants. The amount of the substance ingested, as well as its physical and chemical state and the length of time it is retained in the gastrointestinal tract, should also be considered. These factors are largely unknown as far as wild-living pheasants are concerned.

4. Responses of Bobwhites to Habitat Manipulation   J. A. Ellis, K. P. Thomas

Hunters harvested 411 quail on the Forbes Area and 242 quail on the Dale Area in 1967. The harvest of quail in 1967 was 80 percent and 13 percent higher on the Forbes and Dale areas, respectively, than in 1966. Higher prehunt populations on both areas in 1967 were believed partially responsible for the increased kills. Hunting effort (gun-hours) was the same on the Dale Area in both 1966 and 1967. On the Forbes Area, hunting effort increased 47 percent in 1967, compared with 1966.

The harvest on the two areas in 1967 represented 80 percent of the prehunt population on the Forbes Area and 60 percent of the prehunt population on the Dale Area. Since 1963 both areas have sustained an average harvest of 65 percent of the prehunt populations. We may conclude, therefore, that the productivity of the bobwhite is geared to withstand heavy harvests in addition to winter mortality.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

Prairie chicken habitat is commonly thought to consist of large, unbroken expanses of native prairie or domestic grassland with few sharp breaks between different cover types. While this may be true in the colder and drier portions of the range of the greater prairie chicken, it appears that proximity to field edge is important to nesting hens under current conditions in Illinois. During the period 1963-67 at Bogota, a sample of 64 prairie chicken nests had a median distance of 27 yards from nest site to nearest field edge. The distances ranged from 0 to 154 yards. Two-thirds of the 64 nests were in the outer 50 percent (acreage basis) of the fields in which they were located. Cover types in which the nests were found included redtop, timothy, fescue, wheat stubble-clover mixtures, annual weeds, and weedy corn stubble.

Further analysis of these data revealed apparent differences with respect to age and type of cover. For example, median distances, in yards, from nest sites to nearest field edges were 41.0 (17 nests), 35.0 (4 nests), 29.5 (2 nests), and 21.0 (17 nests) for redtop stands in their 2nd, 3rd, 4th, and 5th year (or older) of growth, respectively. Four nests in 1st-year redtop had a median distance of only 14 yards. Thus, with the exception of 1st-year redtop, both a progressive decline in nest densities as described previously (Monthly Wildlife Research Letter 10(10):3) and a progressive shift of nesting hens to field edges can be expected with increasing age of redtop sods. Prescribed burning and delayed hay harvesting, as well as periodic plowing and reseeding, are among possible rejuvenation techniques which need to be tested on sanctuary grasslands.

6. Rabbit Management — J. A. Bailey, J. C. Hanson

Biologists in Missouri have described ulcerative enteritis as a disease in the cottontail rabbit. The disease can be caused by intraspecific stress due to crowding. Among its symptoms are profuse diarrhea, gastric ulcers, and enlarged adrenals.

In Illinois, experience with caged and penned cottontails had produced little evidence of ulcerative enteritis. During the past 2 years, effects of crowding upon male rabbits have been studied in four experiments using six outdoor pens. Most of this research has been conducted by Mr. Raymond Schroeder, a former student assistant with the Section of Wildlife Research.

Wild male rabbits were live-trapped and placed in the pens in groups of two or four animals per pen. Supplemental food was provided while the rabbits were in the pens for from 30 to 58 days. At the end of each of the four experiments all the animals were collected and autopsied. Pooling the data for all experiments produced 20 animals kept two per pen and 40 animals kept four per pen.

The average ratio of the fresh weight of both adrenals to body weight for rabbits kept two per pen was 20.1 (10^{-5}). For rabbits kept four per pen the average ratio was 18.4 (10^{-5}). The difference between these averages was a likely result of chance. (The probability of obtaining as large or a larger difference was about 30 percent.) Thus, there was no evidence that crowding, in these experiments, affected the sizes of the adrenal glands of the male cottontails.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois March, 1968 Vol. 11, No. 3

1. Pheasant Populations and Land Use

S. L. Etter, R. E. Greenberg

On the assumption that mortality due to causes other than hunting is equal in both sexes of juvenile and adult pheasants, it should be possible to calculate the proportionate harvest of cock pheasants in each age group from the changes in sex ratios obtained during the prehunt and posthunt trapping periods. By using this method of estimation, it was calculated that 74 percent of the juvenile cocks and 56 percent of the adult cocks alive at the beginning of the hunting season in 1962 were harvested. The estimated harvest rates in 1963 were 65 and 50 percent for juvenile and adult cocks, respectively. Although the statistical validity of these differences could not be demonstrated, the data strongly suggested that juvenile cocks were more vulnerable to hunting than were adults.

It was pointed out in a previous report (Monthly Wildlife Research Letter 9(10):1) that the age ratios of cocks harvested during the hunting season were nearly equal to the age ratios of cocks captured during the prehunt trapping period. At that time the similarity of the age ratios obtained by these two methods was interpreted as indicating that juvenile and adult cocks were equally vulnerable to trapping and to hunting. Although juveniles are probably more vulnerable than adults to both hunting and trapping, it now appears more likely that the agreement of the age ratios obtained by trapping and by hunting resulted from a higher vulnerability of juvenile cocks to hunting than to trapping, which nearly compensated for an assumed higher juvenile mortality rate during the period from trapping until the opening of the hunting season.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

During the period February 20-22, Department of Conservation biologists contacted farmers on the Ford County Management Unit to seek permission for the seeding of roadsides, scheduled for August 1968. Of the 65 farmers contacted, 58 (approximately 90 percent) agreed to take part in the program, 3 declined, and 4 were undecided. The extent to which farmers are willing to participate in the program is encouraging, and represents a greater degree of acceptance than was expected. The roadside acreage on the farms involved in the program is over 93 percent of the total acreage for which permission to seed was requested. The proportion will increase accordingly should any of the four undecided farmers ultimately agree to participate in the program.

3. Factors Influencing Distribution and Abundance of Pheasants

W. L. Anderson

Final analyses of data accumulated during the investigation of possible effects of inorganic ions on the distribution of pheasants have revealed some interesting differences among birds from good, fair, and poor pheasant

range (Ford and Livingston counties, northern Coles County, and Neoga Release Area in Cumberland County, respectively). Of particular interest is the finding that, of 15 internal organs analyzed, all except bursae and livers contained lower concentrations of ash in pheasants from poor range than in birds from good range. The mineral concentrations in organs from birds representing fair range also were lower than in those of birds from good range; the only exceptions among 13 organs for which comparisons were possible were concentrations in adrenals, gizzard linings, and livers. When the internal organs were considered collectively--as though they were one, large sample--concentrations of ash in them were calculated to be 1.25, 1.13, and 1.15 percent for birds from good, fair, and poor pheasant range, respectively.

Concentrations of major elements in internal organs, when considered collectively, exhibited area-to-area differences similar to those evident among the percent ash of these tissues. All five major elements for which analyses were conducted (calcium, magnesium, phosphorus, potassium, and sodium) were less abundant in organs from pheasants from poor and from fair range than in organs from birds from good range. Although the differences are small in some instances, ranging from 6 percent for phosphorus to 28 percent for calcium, they are difficult to ignore in view of their consistency.

There were 11 trace elements whose concentrations in pheasant tissues exhibited area-to-area differences that seem worthy of emphasis. Four of these (aluminum, barium, manganese, and titanium) were less than 50 percent as abundant, and five (chromium, lead, nickel, vanadium, and zirconium) at least twice as abundant, in blood, livers, or kidneys from pheasants from poor range as in these tissues from birds representing good range. Cobalt, as well as molybdenum, exhibited conflicting area-to-area differences, birds from poor range compared with birds from good range, in two or more of the tissues, blood, livers, and kidneys. Concentrations of aluminum and of manganese in kidneys, and of titanium in livers were directly related to abundance of pheasants in the three ranges. Conversely, concentrations of lead and of vanadium in kidneys were inversely related to pheasant abundance.

The many area-to-area differences in elemental concentrations in pheasant tissues, as well as in soil, grit, and foods, found during this study make it difficult to discount any element or group of elements as being unimportant in limiting the distribution of ring-necked pheasants in Illinois. For the same reason, it is almost equally as difficult to single out individual elements as having greater influence than others on pheasant abundance. Nevertheless, on the basis of findings of this investigation, suspicion might be directed first toward the elements calcium, magnesium, potassium, chromium, cobalt, and molybdenum. Concentrations of calcium, magnesium, and potassium in soil, as well as in pheasants, were less in poor range than in good range. Chromium, cobalt, and molybdenum are suspected of possibly influencing the abundance of pheasants more than other trace elements because (1) they are essential; (2) they exhibited area-to-area differences in concentrations in at least two of the three tissues, blood, livers, and kidneys; (3) concentrations of chromium in blood and of molybdenum in livers increased with increases in age in pheasants from poor range but not in pheasants from good range; and (4) chromium and molybdenum, plus the "nonessential" element lead, were the only trace elements whose area-to-area differences in concentrations in pheasant tissues were directly related to differences in grit collected in the three ranges.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis, K. P. Thomas

The harvest resulting from a management program is a criterion for evaluating the effect of the program. During the hunting season in 1967 on Forbes, 54.8 quail per 100 acres were harvested on the experimental management zone. This harvest figure represented an increase of 80 percent over the harvest of 1966. On the remainder of the Forbes Area, 13.4 quail per 100 acres were harvested in 1967, an increase of 72 percent over 1966. Hunting effort (gun-hours) on the experimental management zone in 1967 increased 74 percent over the effort expended in 1966. On the remainder of the Forbes Area, hunting effort in 1967 increased 94 percent over that of 1966.

On the Dale Area, 35.8 quail per 100 acres were harvested on the experimental management zone in 1967, an increase of 118 percent over 1966. On the remainder of the Dale Area, 18.2 quail per 100 acres were harvested, a decrease of 11 percent from 1966. Hunting effort on the experimental management zone was similar to that on the remainder of the area in both 1966 and 1967. Thus, harvests on the Dale and Forbes areas were reflections of the difference in the quality and quantity of quail habitat on the experimental management zones compared with that on the remainder of the areas.

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier

Leasing of nesting cover on private farmland for prairie chickens has cost from $10.00 to $30.00 per acre per year. Such expense cannot be justified except as a stopgap measure to provide critically needed nesting cover until it can be provided on permanent sanctuaries. The types of cover available for leasing have also constituted a problem confronting effective leasing.

In 1963 only three prairie chicken nests were found by systematic searching in 234 acres leased on the Bogota Study Area by the Illinois Department of Conservation. The primary type of cover leased in 1963 was red clover. By contrast, in 1967, 85 acres of leased grassland produced four known nests (found by searching) and a probable minimum of four other nests--based on observations of hens during the spring booming season, subsequent observations of broods, or both. Booming activities were noted within 1/4 mile of each of the five leased tracts in 1967. Cover types leased in 1967 included two timothy seed meadows (36 acres), one redtop seed meadow (21 acres), one mixed stand of undisturbed redtop and timothy (23 acres), and a 5-acre patch of mixed wheat stubble-timothy-red clover. Thus, it can be concluded that when grassy cover types are available for leasing in areas of high traditional use by prairie chickens, leasing can be justified on a temporary, short-term basis.

6. Rabbit Management J. A. Bailey, J. C. Hanson

During the past 4 years cottontails have been collected from the University of Illinois farms near Urbana in order to compare the adrenal weights of these wild rabbits with those of rabbits experimentally stressed in cages or crowded pens. The wild rabbits have been collected by either live-trapping or by hunting during the evening. Adrenal weights are usually expressed on a relative-to-body-weight basis, and it was hypothesized that

relative adrenal weights of trapped cottontails would be larger than those of hunted rabbits because the trapped animals had spent within traps all or part of their usual nighttime feeding period, and should have lost weight. This hypothesis was tested by comparing the relative adrenal weights of 25 trapped adult male rabbits with those of 10 hunted adult males and by comparing the relative adrenal weights of 25 trapped juvenile male rabbits with those of 23 hunted juvenile males. Relative adrenal weight was expressed as 10^5 times the ratio of the fresh weight of both adrenals to body weight.

The average relative adrenal weight of trapped adult male rabbits was 25.68, 25 percent larger than that of hunted adult males (20.52). The difference was statistically significant ($\underline{P} < 0.03$). The average relative adrenal weight of trapped juvenile male rabbits was 19.36, 10 percent larger than that of hunted juvenile males (17.66). The latter difference was not significant ($\underline{P} < 0.15$), but the hypothesis that relative adrenal weights of trapped cottontails are biased upward and should not be compared with those of hunted rabbits is accepted on the basis of the two tests.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois April, 1968 Vol. 11, No. 4

1. Pheasant Populations and Land Use

S. L. Etter, R. E. Greenberg

During the period April 17-27, 1967, all passable roads on the Sibley Study Area were driven a total of 9 times in order to observe pheasants. The observation period each morning began at sunrise and continued until the entire area had been covered. Starting points were staggered so that no one portion of the study area was consistently covered earlier than other portions.

For the above period, a total of 1,109 observations (367 cocks, 742 hens) were recorded during the 5 hours following sunrise. The sex ratios of pheasants observed during the 1st, 2nd, 3rd, 4th, and 5th hours after sunrise were 39, 45, 53, 83, and 78 cocks per 100 hens, respectively. The consistent increase in the proportion of cocks apparently results from a greater association of hens with cocks before and during the 1st hour or so after sunrise than during the later hours of the morning. Territorial cocks remain relatively conspicuous throughout most of the day, but hens apparently retire to loafing areas not readily observable from the roadsides. Secondly, many inactive hens unaccompanied by the more conspicuous cocks are probably missed against the background of plowed ground.

Because of the sex differential in the behavior of pheasants during the April 17-27 period, the observed sex ratios probably overestimated the proportion of cocks in the population. Whether the sex ratios obtained during the first hour after sunrise indicated the true sex ratio is unknown.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

A trend toward minimum mowing of state highway roadsides has been noted in recent years. This development is desirable from two standpoints: economy of maintenance and wildlife conservation. However, before any extensive changes in policies of roadside maintenance are made, more information should be obtained to evaluate:

1. Any change, possibly due to reduced mowing schedules, in the hazard created when wildlife species strike vehicles.

2. Public reaction to unmowed grasses and legumes beyond the ditch line.

3. Management practices: whether reseeding of roadsides is necessary, or whether fertilization or other management of existing vegetation will suffice to make roadside vegetation acceptable to both the traveling public and ground-nesting birds.

In an attempt to answer some of these questions, the Illinois Division of Highways, the Department of Conservation, and the Natural History Survey have

recently concluded an agreement for experimental management of vegetation on roadsides along Illinois Highway 47 in Ford and Livingston counties. Three, 1-mile segments of roadsides along both sides of highway 47 between Gibson City and Strawn will be seeded with brome (Bromus spp.) and alfalfa (Medicago sativa) from the ditch to the right-of-way line. Treated segments in this phase of the experiment are to be separated by at least 1 mile of unseeded (control) roadsides. Seedings are scheduled for the last week of April.

On a 4½-mile segment of roadside along highway 47, north of Strawn in Livingston County, there will be six replications of each of three fertilizer applications from the ditch to the right-of-way line: nitrogen only, phosphorus only, nitrogen and phosphorus combined. Control plots will receive no applications of fertilizer (six replications). Half of the fertilized and half of the control plots will be treated with a herbicide to control broad-leafed weeds.

Treated segments of roadsides (seeded and fertilized portions and controls associated with fertilizer experiments) will not be mowed; mowing of ditches and shoulders will be done as usual along the treated segments, as will mowing of the entire control roadsides separated by seedings.

The highway will be driven at frequent intervals during the spring and summer to compare the frequencies of pheasant roadkills along seeded and fertilized plots and associated controls.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

It seems likely that the factors dictating the distribution and abundance of pheasants in Illinois would manifest themselves within the physiological mechanisms carrying on life processes of individual birds. Hence, pheasants from poor pheasant range might be expected to differ physiologically from birds from good range. To pursue this line of reasoning, 10 juvenile hens each were collected from poor range (Neoga Release Area in Cumberland County) and from good range (Ford and Livingston counties), during February 1968, and were dissected to determine weights of muscle groups, of fat deposits, and of internal organs. The "average" hen from poor range differed from the "average" hen from good range in having heavier body weight (901:865 g), heavier sternal muscles (253: 237 g), and smaller adrenal glands (70: 89 mg). These differences were significant at the 95 percent level of confidence; all other differences were not statistically significant.

These findings prompted a reexamination of data obtained from hen pheasants collected in poor range and in good range in previous years. It soon became apparent that juvenile hens from poor range had, on the average, significantly smaller adrenals than juvenile hens from good range (mean weights of adrenals from juveniles collected during October 1966 and January 1967 were 70: 78 mg and 65: 89 mg, respectively). Differences were not evident among adrenals from adult hens. If size of the adrenal is a reliable indicator of stress, the available data indicate that juvenile hens in poor pheasant range are subjected to less stress than those in good range. This is contrary to what might be expected.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, K. P. Thomas

Since 1964, the general trend in the upland-game management program conducted on the Forbes and Dale areas by the Division of Game has been toward reduced acreages of food plots. The emphasis has shifted from summer seedings of corn (*Zea mays*), three millets (*Panicum miliaceum*, *Pennisetum glaucum*, *Setaria italica*), milo (*Sorghum vulgare*), and buckwheat (*Fagopyrum esculentum*) to establishment of wheat (*Triticum aestivum*) plots in the fall.

On Forbes, from 1964 to 1966, the number and acreages of food patches declined from 307 patches occupying 114 acres to 103 patches totaling 21 acres. In 1967, 116 plots, comprising 28 acres, were established; 60 percent of this acreage was wheat.

The number of summer food patches on the Dale Area remained relatively constant (38 - 44) from 1964 to 1967, but the acreages of food plots were reduced from 36 to 10 during the same period. The number of wheat plots on Dale increased from 7 in 1964 to 30 in 1967; the acreage of wheat decreased from 51 in 1964 to 19 in 1967.

One reason for establishing food patches has been to control plant succession. In many instances, however, food patches have been established in the same locations for several years. This practice does not control plant succession and negates the value of the food plants and associated weeds, particularly during the 2nd year.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

Counts of booming prairie chickens on the Bogota Study Area between January 24 and April 19, 1968, revealed a slightly decreased number of cocks since the spring of 1967. The highest count of cocks, among 20 early-morning surveys in 1968, was 37 (on April 10), 14 percent less than the peak count of 43 cocks (on March 25) in 1967. Highest counts of cocks at Bogota during the four springs 1963-66 were 78, 65, 42, and 41, respectively.

On private farmland at Bogota, the cover types most important to nesting hens, including grass seed meadows, undisturbed grass, and grass hay meadows, declined from 595 acres in 1963 to only 219 acres in 1967. Of these 219 acres, 85 were present in 1967 primarily because of 1-year leases made between local farmers and the Illinois Department of Conservation. Permanent sanctuary acreage has increased substantially at Bogota since 1963 (presently 687 acres in 10 tracts), but the amount of established nesting cover on sanctuaries did not reach significant proportions (338 acres) until 1967. Even in 1967, 60 percent (204 acres) of the 338 acres of nesting cover on sanctuaries was not used by prairie chickens, because the sanctuaries were either too new or too far away to be of immediate benefit to nesting hens. While all sanctuaries are located in potentially excellent sites, five tracts totaling 335 acres are located where prairie chickens were found several years ago--but not in 1967. All five tracts were within easy flight distances for nesting hens in 1967, but due to traditional habit or the newness of the tracts, or both, the birds did not take advantage of the nesting opportunities.

A point of greater concern is that the number of prairie chicken nests on the 77-acre Yeatter Sanctuary (the oldest tract) declined from a high of 15 nests

in 1964 to only 2 nests in 1967, even though more hens have been seen on the booming ground on this tract during recent years than during the years 1963-64. Renovation initiated in 1966 on the Yeatter Sanctuary should help reverse this trend.

Although it is impossible to account fully for the lower number of prairie chicken cocks at Bogota in the spring of 1968, the effects in 1967 of (1) continuing losses of nesting cover on private farmland, (2) limited or no use of the newer sanctuaries, (3) declining use of the oldest sanctuaries, and (4) a high rate (46 percent--the highest recorded at Bogota) of nest destruction by predators all probably played roles in the population decrease.

6. Rabbit Management J. A. Bailey, J. C. Hanson

Biologists in other states have experienced difficulty in keeping cottontail rabbits alive in cages. A disease, ulcerative enteritis, characterized by diarrhea, inflammation of the digestive tract, and enlarged adrenal glands has been associated with the early deaths of caged rabbits. In one series of caged rabbits in Missouri, 28 percent of the animals died within 10 days, 59 percent within 20 days, and 85 percent within 40 days.

In contrast, few rabbits caged at the Illinois Natural History Survey have shown symptoms of ulcerative enteritis and died. An experiment designed to measure effects of caging upon the adrenal glands of cottontails was initiated in July, 1967, by Mr. Raymond Schroeder. Male rabbits, captured in live traps on the University of Illinois farms near Urbana, were either autopsied on the day of capture or were caged for from 1 to 5 days before autopsy. Most rabbits lost weight during caging. The weight of each rabbit's adrenals was therefore expressed as the ratio (10^5) of fresh weight of both glands divided by the weight of the animal when first captured.

Preliminary results are: relative adrenal weights of cottontails averaged 19.6 on the day of capture, 15.5 after 1 day of caging, 21.9 after 2 days, 22.8 after 3 days, 19.5 after 4 days, and 19.1 after 5 days. Relative adrenal weights were lower and also less variable for rabbits caged for 1 day than for rabbits in any of the other categories. This finding suggests a depletion of the adrenals in response to capture, a hypothesis to be investigated by examining histological sections of the glands. There was no evidence among adrenal weights that the glands of these cottontails had enlarged in response to caging for up to 5 days.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | May, 1968 | Vol. 11, No 5

1. Pheasant Populations and Land Use — S. L. Etter, R. E. Greenberg

The responses to questionnaires requesting information on hunting pressures and kills during the regular pheasant hunting season and the 2-week extension, in 1967, by hunters who had returned tags or bands from cocks killed on the Sibley Study Area were discussed in a previous report (Monthly Wildlife Research Letter 11 (2):1). Similar questionnaires were sent to 292 hunters who indicated on the regular hunter-questionnaires issued by the Department of Conservation that they had hunted pheasants during 1967.

A total of 178 hunters replied to these questionnaires. Nine of the responding hunters could not remember the number of days they hunted during each period, nor the number of cocks they killed The 169 hunters who supplied complete information indicated that they hunted 792 days during the regular season and 300 days during the extended period The reported kills were 376 cocks and 136 cocks during the regular season and the extended period, respectively. These data indicate an increase of 38 percent in hunting effort and an increase of 35 percent in the kill over that which would have occurred without the season extension

The Sibley sample indicated increases of 53 percent and 57 percent in hunting effort and kill, respectively, resulting from the extended season The greater hunting pressure during the extended period, indicated by the Sibley sample as compared with the statewide sample, resulted primarily from the proportionately greater number of hunters that hunted during this period (72 percent, Sibley sample; 54 percent, statewide sample).

2. Manipulation of Pheasant Habitat — G. B. Joselyn

During December 1966, questionnaires were sent to the Chief Highway Engineers in 13 states and to two turnpike commissions. Included in the survey were the states of Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Nebraska, North Dakota, Ohio, South Dakota, Pennsylvania, Wisconsin, and the Ohio and Pennsylvania turnpikes Portions of each of these states possess sizable populations of pheasants. The primary purposes of the questionnaire were (1) to obtain information on current practices of highway roadside maintenance and (2) to determine the attitude of highway administrators regarding management of highway roadsides for nesting birds. All 15 questionnaires were returned.

Data from the questionnaires indicate the methods of roadside vegetation management currently employed in the states polled. Of the 15 respondents, 5 (33 percent) reported that highway roadsides were mowed from fence to fence, beginning with the first mowing each summer Six (40 percent) engineers reported that roadsides were mowed beyond the ditch only once, in late summer, and four (27 percent) indicated that no mowing was done beyond the ditch. Thus, 10 of 15 respondents could be considered as employing minimum mowing schedules beyond the ditch

Eleven engineers (73 percent) reported that spraying was used to supplement mowing, and five that spraying was used to eliminate one or more mowings.

Ten respondents (66 percent) revealed that changes in mowing policy had been made over the last 10 years, but 13 (87 percent) did not anticipate any further changes in the near future: One of the two respondents that expected changes to be made anticipated less mowing; the other expected more mowing in areas where herbicides have proven ineffective.

Of the 11 engineers responding to a question on changing costs of mowing, 8 (73 percent) reported increases in mowing costs and 3 (27 percent) reported decreases. According to these estimates, per acre mowing costs increased an average of 5 percent each year since 1960. Ten respondents provided figures on mowing costs. Annual per acre mowing costs averaged $11.86 for two-lane highway roadsides and $17.78 for four-lane and Interstate roadsides; the average for all highways was $15.19 per acre. A study conducted by the Department of Agricultural Engineering at the University of Illinois revealed that in 1959 mowing costs for highway roadsides were $10.21 per acre per year.

Two significant points can be made from these data: (1) the cost of vegetation control along highways is increasing, with no evidence to suggest that this trend will change without major changes in maintenance policies; and (2) through the use of selective herbicides and realistic mowing programs, many states among those surveyed are attempting to place costs of roadside vegetation management in a better perspective relative to the total budget for highway maintenance.

Changing concepts of maintenance applied to newly constructed and existing roadsides can and are resulting in sizable acreages of undisturbed cover on highway roadsides throughout much of the country The potential benefit of these changes for pheasants and other ground-nesting birds could be substantial.

3. <u>Factors Influencing Distribution and Abundance of Pheasants</u> W. L. Anderson

Audio censuses of calling cocks revealed that at least 57 cock pheasants were present on the Neoga release area during May 1968. This count of breeding cocks is 30 percent greater than the number counted during May 1967 (44 cocks) and 293 percent greater than the all-time low count (16 cocks), made during May 1964. The increase noted from 1967 to 1968 represents the 4th consecutive year that the population of breeding cocks has increased on the area. These findings offer continued encouragement that a permanent, low-density population of pheasants is becoming established in the vicinity of Neoga.

4. <u>Responses of Bobwhites to Habitat Manipulation</u> J. A. Ellis, K. P. Thomas

The program of prescribed burning, initiated on a 250-acre portion of the Dale Area in March 1966, has produced a dramatic population response by quail. During the prehunt census in 1967, 129 quail were found in the burned zone, an increase of 126 percent over the prehunt estimate of 1966 (57 quail). The prehunt population on the burned zone in 1967 was 38 percent higher than any other prehunt population since the fall of 1963.

A population loss of 10 percent from the posthunt census (62 quail) to the prebreeding census (56 quail) was recorded on the burned zone in 1968. The remainder

of the Dale Area, however, sustained a population loss of 66 percent during the same period. The prebreeding population on the burned zone in 1968 was 500 percent higher than any other prebreeding population recorded on this zone since the late winter of 1964. If the size of the prebreeding population continues to determine the size of the subsequent prehunt population, a substantial increase in the prehunt population in 1968 would be expected on the burned zone. Thus, burning appears to be an effective and economical tool in quail management.

5. Responses of Prairie Chickens to Habitat Manipulation. R. L. Westemeier

During the spring period of late March to mid-April, 1968, 19 areas in eight counties in south-central Illinois were systematically cruised in search of booming prairie chickens. Censuses were discontinued on four areas where no prairie chickens were found in the spring of 1967.

A total of 143 booming cocks were found on 13 of the 19 areas surveyed. In addition, a remnant flock near Hoyleton in Washington County, learned about in May 1968, reportedly (by local residents) contained six cocks. Thus, by assuming a 50:50 sex ratio, the known statewide population of prairie chickens numbers about 300 birds in 14 flocks this spring. On comparable surveyed areas, there were 19 percent fewer cocks this spring than the statewide count of 177 cocks found in 1967. Decreases were recorded on 11 areas, 3 of which were totally defunct (the West Liberty and Shamrock areas in Jasper County and the Hookdale Area in Bond County). No change took place on three areas, one of which was the Hunt Area in Jasper County, where a single cock has been found for the past three springs. Increased population levels since 1967 were noted on two areas: (1) near Loogootee; an area which overlaps Effingham and Fayette counties, and (2) near Fairman; an area which overlaps Marion and Clinton counties.

The Bogota Area, the main management and research area, sustained the smallest decrease (-14 percent) among the areas on which declines were recorded, and continued to support the largest self-contained flock (37 cocks) of prairie chickens in Illinois. It is interesting that the birds on five areas either held their own or increased in number with little or no deliberate habitat management.

6. Rabbit Management J. A. Bailey

If information on food preferences and nutrition of wild cottontails is to find application in habitat management, there must be an awareness of seasonal variation in the availabilities and nutritional values of plant foods and also of the fact that young, growing animals have nutritional requirements differing from those of full-grown animals.

The physiological condition of a plant, as determined by its stage of maturity, recent weather, soil conditions, and the maturity-delaying effects of mowing or grazing, influences its palatability and its content of digestible nutrients. Thus, foods that are preferred and nutritious at one stage of growth may be poor foods for cottontails at other stages, and food-habits studies must be related to this seasonal variation.

Basal metabolic rate per unit of body weight is greater for small animals than for large animals and also greater for young animals than for mature animals. Young animals also require large amounts of energy for the processes of growth. Therefore, the energy requirements of young animals are considerably greater than

those of mature animals, when measured relative to body size and to the capacity of the digestive tract. Young animals usually compensate for their relatively greater requirements for energy, as well as other nutrients, by eating more continuously than mature animals and also by eating highly digestible foods. Thus it cannot be assumed that foods adequate in digestible nutrients for mature animals will suffice for young, growing animals.

In 81 feeding trials during spring, summer, and autumn, young cottontails survived longest and made the largest gains in body weight on foods that were palatable and most digestible. The coefficient of linear correlation between weight changes and kcal (kilocalories) digested per day per metabolic body size ($kg^{0.75}$) was 0.72 ($\underline{P}<0.001$). It is concluded that digestibility of food is an especially important factor in the nutrition of young cottontails.

The Assistant Project Leader, J. C. Hanson, resigned effective June 24, 1968. Jeff hopes to obtain his commercial pilot's license and perhaps continue working in the wildlife field as a pilot-biologist.

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Monthly Wildlife Research Letter

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois June, 1968 Vol. 11, No. 6

1. Pheasant Populations and Land Use — S. L. Etter, R. E. Greenberg

Analysis of the fates of 846 pheasant nests located in hayfields on 100, 10-acre plots on the Sibley Study Area during the period 1962-67 revealed that 17 percent (144) of these nests were successful. Success rates of nests in individual hayfields differed considerably as a result of the farming practices to which the nests were subjected. Success rates of nests in unharvested hayfields, harvested hayfields, and hay pastures were 34, 10, and 21 percent, respectively. On the assumption that the success rates of nests established in harvested hay and hay pasture, had the nests remained undisturbed, would have equaled that of nests in unharvested hay, grazing and hay mowing resulted in the destruction of about half of the potentially successful nests in this cover type.

Since nests located in hayfields accounted for 58 percent of the total number of nests found during this period, nest losses resulting from hay mowing and grazing are of considerable importance in pheasant production. These data demonstrate the drastic effect of farming operations on the nesting ecology of pheasants in east-central Illinois.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

Since 1963, vegetation on seeded and on managed control roadside plots has been studied to determine changes in plant-species composition (frequency of occurrence) and the percentages of top cover contributed by various species. Two locations on each 220-yard plot (one on each half) and four locations on each 440-yard plot (two on each half) were selected at random. At each location three vegetative samples were taken (one each on the foreslope, ditch, and backslope) with a foot-square quadrat during mid-July. Information was recorded on species occurrence, height, and contribution of each to total top cover in each quadrat. During the 5 years, 1963-67, 1,552 quadrats were taken on seeded plots. Data thus obtained provide insights into vegetative changes on the plots over the 5-year period.

Of the five species of grasses and legumes seeded on roadsides in 1962, only brome grass (Bromus spp.) increased in frequency of occurrence as the plots grew older. On 1-year-old plots, brome occurred in 66 percent of the quadrats taken, and increased each year thereafter to where 98 percent of the quadrats taken on plots 5 years old contained brome. Alfalfa (Medicago sativa) appeared in 72 percent of the quadrats on year-old plots but decreased slightly to 65 percent on plots 5 years of age. Red clover (Trifolium pratense) was present in half the quadrats the 1st year after establishment but dropped to only 8 percent occurrence the 2nd year; by the 5th year, red clover was present in less than 1 percent of the quadrats taken. Timothy (Phleum pratense) and orchard grass (Dactylis glomerata) were present in from 10 to 20 percent of the quadrats in each age group.

It was anticipated when the seedings were established that brome would eventually become the dominate species on the roadsides, and that with decreasing amounts of alfalfa (to provide nitrogen for the brome), the quality of the brome and with it the quality of the roadsides as pheasant nesting cover would decrease. Data obtained from the quadrats show that alfalfa has held up well on the roadsides through 5 years of age. This may indicate that seeded roadsides will be retained as quality nesting cover longer than was at first anticipated.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

The body weights of 11, actively laying hen pheasants collected in Ford and Livingston counties between April 22 and May 29, 1968, averaged 1,080 grams. This compares favorably with the mean weights of hens collected during the same period in 1966 (1,045 grams) and in 1967 (1,075 grams). Mean weights of selected tissues and organs excised from the hens collected in 1968, compared with those from hens collected in 1966 and in 1967, respectively, were: sternal muscles, 100 and 100 percent; fat strip, 127 and 122 percent; visceral fat, 122 and 92 percent; liver, 99 and 88 percent; and ovary, 134 and 94 percent. Counts of ruptured follicles in the ovaries indicated that the hens collected in 1968 had laid, on the average, 12.5 eggs, which is similar to the average number of eggs laid by hens collected in 1966 (12.3 eggs) and in 1967 (14.1 eggs).

These findings suggest that hen pheasants in east-central Illinois entered the nesting season in better physical condition in 1968 than in 1966--a year of "average" production--and in about the same condition as in 1967--a year of excellent production. Hence, it is predicted that pheasant production will be above average in 1968.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis, K. P. Thomas

To gain insight into the chronology of hatching of quail, the length of the last molted primary was measured for 624 wings collected from juveniles during the hunting seasons (1964-67) on the Dale and Forbes areas. The age in days was extrapolated, for each bird, from published data. By backdating from the dates of collection, the dates of hatch were determined for birds less than 150 days of age. Of the 624 wings examined, 14 were older than 150 days when collected.

From this sample of wings, the earliest date of hatch was June 15 (1966) and the latest date of hatch was October 2 (1965); both birds were from the Dale Area. The mean dates of hatch ranged from July 12 on Forbes in 1965 to July 31 on Forbes in 1967.

The average percent of hatch after July 20 was relatively low on Forbes (32 percent) and Dale (40 percent) during the period 1964-66. However, 64 percent and 55 percent of the juveniles in the samples in 1967 were hatched after July 20 on Forbes and Dale, respectively, which probably influenced the high population levels on both areas in the fall of 1967.

In general, mean dates of hatch of quail were found to correspond to the number of juvenile cocks/adult cock among birds caught in cock-hen traps during June and July, i.e., the greater the number of juvenile cocks/adult cock, the earlier the mean date of hatch, and, consequently, the lower percentage of young produced after July 20. Factors causing differential age ratios among juvenile and adult cocks

in the traps also appear to influence the degree of late nesting and the relative abundance of quail in the subsequent fall.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

Habitat management for prairie chickens on sanctuaries on the Bogota Study Area has chiefly consisted of combining redtop and timothy for seed, or mowing for weed control. Mowing aids in the control of noxious weeds and of encroaching woody vegetation. However, nest studies during the period 1963-67 at Bogota have revealed that nest densities decline and hens nest progressively closer to field edges as sod ages, apparently because of the excessive accumulation of dead vegetation resulting from annual combining or mowing.

On sanctuaries owned by the Prairie Grouse Committee of the Illinois Chapter, The Nature Conservancy (PGC), new approaches to vegetative management were initiated in 1967 and 1968 which included prescribed burning, delayed hay harvesting, and limited grazing. Evaluation of the cover which these practices induce is forthcoming, but a dramatic response to burning has already been noted at Bogota on one of five fields totaling 40.5 acres burned between February 28 and March 30, 1968.

The 140-acre Zimmerman farm was acquired by the PGC in March 1966, at which time the cover on the farm was primarily soybean stubble and small grains. The farm received practically no use by prairie chickens until February 1968, by which time the 140-acre tract contained 15 types of grass and grass-forb mixtures. By March 30, 1968, a booming ground became well established on a 10-acre burn made on February 28 in the center of the Zimmerman Sanctuary. The burn was made in 5 acres each of a timothy-prairie grass stand and a redtop seed meadow. Peak counts of 6 cocks and 10 hens (possibly one-third of the hen population in the Bogota flock) were seen on the lush green vegetation that appeared after the burn. A 4.5-acre field adjacent to the 10-acre burn was mowed down to ground level as a potential booming ground, and, although the prairie chickens began booming on the mowed field, a shift to the burned field was clearly evident after the burned sod turned green. As of June 19, 1968, four prairie chicken nests have been found in 45 acres searched on the 140-acre Zimmerman Sanctuary, and seven brood observations have been made on or within ¼ mile of the tract. It is hoped that the prairie chickens will respond similarly to the newly implemented management practices on the other recently acquired sanctuaries at Bogota.

6. Rabbit Management — J. A. Bailey, K. P. Thomas

During 1967-68, personnel of the Illinois Department of Conservation collected eyes from samples of rabbits harvested on the Sam Dale State Park in Wayne County, on the Stephen A. Forbes State Park in Marion County, and on the McLean County Conservation Area. The Dale and Forbes areas have been studied in this manner since 1963; the McLean area had not been studied nor open to public hunting before 1967. As in previous years, the ages of harvested rabbits were estimated according to weights of their eye lenses.

Seventy-five percent of 110 cottontails harvested during November and December on Sam Dale State Park were juveniles. During the past five hunting seasons the proportions of juveniles in samples of rabbits from the Dale Area have averaged 76 percent, and the average date of birth of juveniles has been during late April or early May.

In contrast, 93 percent of 142 rabbits harvested on the Stephen A. Forbes State Park were juveniles; this is an unusually high proportion of juveniles. During the past five hunting seasons the proportions of juveniles in samples of rabbits from the Forbes Area have averaged 84 percent and the average date of birth of juveniles has been near June 1 in 4 of the 5 years. Apparently, rate of population turnover has been higher on the Forbes Area than on the Dale Area during 1963-67. This may have resulted from greater overwintering and hunting mortality, or greater reproductive success, on the Forbes Area.

Only 47 lenses were obtained from rabbits harvested on the McLean County Conservation Area. Forty-nine percent of the rabbits in this sample were juveniles, indicating that rate of turnover was unusually low in this unhunted population.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois July, 1968 Vol. 11, No. 7

1. Pheasant Populations and Land Use S. L. Etter, R. E. Greenberg

SPECIAL REPORT.--Because of rainy fall weather, the corn harvest in Illinois in 1967 was nearly a month later than normal. By November 30, only 63 percent of the corn had been harvested (Illinois Agricultural Statistics, 1968). As a result of the large acreages of standing corn, pheasant hunting was extremely poor during the regular November 18-December 17 hunting season. Because of the light harvest of cocks during the regular season, the Department of Conservation issued an administrative order, on December 12, extending the 1967 pheasant hunting season to include the 2-week period December 18-31.

To assess the effect of the season extension on the harvest of cock pheasants, questionnaires requesting information on number of hunter-days and number of cocks killed during the regular season and during the extended period were sent to a total of 340 hunters. Included in the total were 48 hunters who had returned tags or bands from cocks killed on the Sibley Study Area during the hunting seasons 1963-67 and 292 hunters who indicated on regular Department of Conservation hunter-questionnaires that they had hunted pheasants during the hunting season in 1967.

Final tabulation of the data obtained from 195 hunters who answered our questionnaires and supplied complete information indicated that 110 (56 percent) hunted 1 or more days during the extended period. The reported hunting effort indicated that 29 percent of the season's hunting occurred during the 2-week extended period. Thus, the season extension resulted in a substantial increase in the amount of pheasant hunting beyond that which would have occurred if the season had ended on December 17.

The reported harvest of cocks indicated that 28 percent of the cocks bagged during the entire season in 1967 were killed during the extended period. Reported success rates, 0.55 and 0.54 cock per day for the regular season and extended period, respectively, were essentially equal. Although the additional hunting pressure and kill resulting from the extended season resulted in a higher proportionate harvest of cocks than would otherwise have occurred in 1967, the observed sex ratios after the hunting season in 1967 (42 cocks per 100 hens) were significantly higher than in 1965 and 1966 (32 cocks per 100 hens in both years). This suggested that even with the extension, pheasant harvest was light and more birds could have been taken in 1967.

Attitudes of hunters toward the season extension were favorable. Of 27 hunters in the Sibley sample who returned questionnaires on which they were specifically asked to indicate their opinions of the season extension, 25 indicated approval, 1 was indifferent, and 1 disapproved. Of 31 hunters from the statewide sample who volunteered opinions of the season extension, 25 expressed approval and 6 disapproval.

The questionnaires indicated that the season extension in 1967 was successful in providing additional hunting recreation, and that the increased opportunity to hunt was well received by a large majority of the sportsmen who expressed their opinions of the lengthened season. There is no evidence to indicate that the vulnerability of cock pheasants to hunting was appreciably greater during the 2-week extension than during the regular season, and the additional hunting provided did not result in a high proportionate harvest of cock pheasants--cock harvest in 1967 was considerably lower than that considered desirable for the optimum use of the available pheasant resource.

These findings, in addition to data obtained in previous years when hunting conditions were favorable during the entire season, suggest that there is little likelihood that cock pheasants would, or could be, overshot during seasons as long or longer than the extended season in 1967. Thus, longer seasons appear to be highly desirable in terms of the additional hunting recreation which could be provided and the optimum use of the available resource.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

In 1968, the first search for pheasant nests on manipulated and on managed control plots along 9½ miles of roadway on and near the Sibley Study Area was conducted during the last week of June and first week of July. Fifty-nine pheasant nests were located on the plots, 36 on seeded and 23 on managed control plots. The first search in previous years produced the following totals: 1967, 52 nests (seeded, 30; managed control, 22); 1966, 70 nests (seeded, 44; managed control, 26); 1965, 57 nests (seeded, 35; managed control, 22); 1964, 85 nests (seeded, 52; managed control, 33); 1963, 80 nests (seeded, 40; managed control, 40).

By July 15 this year, 15 nests had hatched on seeded plots and 7 nests had hatched on managed control plots. This represents the greatest number of successful nests on seeded roadsides at this point in the nesting season since 1963, when there were also 15 hatched nests by July 15; 1963 was also the year of greatest successful nest production on seeded roadsides (1.1 hatched nests per acre) during the 5 years of this investigation. By July 15, 1967, only four nests had hatched on seeded roadsides while six had hatched on managed control plots. Thus, pending the outcome of the second search of roadsides in late July, there are indications that successful nest production on seeded roadsides may approach that of 1963.

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson

Twenty-two hen pheasants (11 layers and 11 incubators) were collected in Ford and Livingston counties--the state's better pheasant range--during May and June, 1968. By counting the ruptured follicles in the ovaries of the layers, and by allowing 1.3 days for each ruptured follicle, it was determined that the "average" hen pheasant began laying on April 26 (range, April 12-May 10). The number of ruptured follicles counted in ovaries of the incubating hens averaged 29.9; hence, the "average" hen pheasant laid 30 eggs before she began to incubate a clutch. In 1967, it was estimated that the "average" hen began laying on April 26 (range, April 10-May 15) and laid 31 eggs before incubation began. These findings suggest that onset of laying and the number of eggs laid by hens in the state's better pheasant range were almost identical during the 2 years, 1967 and 1968.

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

After 2 years of participation in experimental management programs on Forbes and Dale, some general statements can be made regarding these programs: The programs resulted in increased quail populations on the experimental management zones on both areas. Quail responded favorably to the sharecropping-burning program on Forbes with a major population increase in only 1 year, but 2 years were required on the experimental management zone on Dale before the quail population responded to controlled burning. The sharecropping-burning program on Forbes drastically altered the habitat during the 1st year. Prior to establishment of this program, most of the open land in this zone had reverted to rank stands of grasses and weeds. Renovation by establishing row crops on half of the open land during the 1st year was probably the single most important factor in creating quality habitat for quail.

Two years of controlled burning on Dale resulted in significant increases in the amount of bare ground and emphasize that the amount of bare ground was probably the key to successful quail management. Sharecropping and large-scale burning appeared to be adequate and economical tools for providing bare ground and also resulted in the occurrence of native legumes and other important quail foods.

For successful quail management, it is now evident that frequent manipulation of the habitat is required. Burning is necessary probably every other year, and where sharecropping is used, row crops should be established every 3-4 years. Rotations occurring at longer intervals than these would fail to maintain the desired habitat conditions.

The Game Division has initiated a sharecropping management program in the northwest portion of the Forbes Area. This portion of Forbes had previously been managed by the establishment of annual food patches.

5. Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier

Midsummer mowing for hay and perhaps close mowing for weed control or for booming grounds appear to be among various methods of maintaining attractive nesting cover for prairie chickens. Six prairie chicken nests have been found in 1968 in four fields, on sanctuaries at Bogota, which were mowed between late June and mid-July, 1967. The mowed fields consisted of a 0.5-acre experimental plot of southland brome (*Bromus inermis* var.), one nest; a 4.5-acre field of timothy (*Phleum pratense*) and red clover (*Trifolium pratense*), one nest; an 18-acre field of weedy sweet clover (*Melilotus* spp.) and red clover, two nests; and a 20-acre field of timothy, two nests.

Regrowth after hay harvests in 1967 in the brome plot and in the 20-acre timothy meadow left residual cover about 10 inches and 18 inches in height, respectively, for the period of nest initiation (early April) in 1968. The timothy field was left in a totally undisturbed condition for the nesting season of 1966 and 1967 but contained no nests either year, in spite of its excellent location--within $\frac{1}{4}$ mile of the largest booming ground in the Bogota Area. Two nests in this field in 1968 are evidence that the midsummer hay harvest in 1967 improved the attractiveness of the field for nesting. The 4.5-acre field of timothy and red clover was also mowed for hay, and, in addition, was mowed to ground level in

October 1967 to provide a booming ground, leaving essentially no residual cover for the successful nest found in the field in 1968. The 18-acre field of weedy legumes was mowed for weed control in 1967 to a height of 3 inches, in compliance with the Federal Feed Grain Program. Cover height in this field was probably about 6 inches at the time of nest establishment in 1968.

Nest densities in the above mowed fields equal or exceed the densities of nests found, so far, this summer in adjacent cover types--undisturbed redtop (Agrostis alba), timothy, weedy legumes or grass seed meadows, or cover appearing after the late-winter burns in 1968. The data presented indicate that (1) light layers of duff on the ground, (2) relatively short residual cover, and perhaps (3) rapid growth of the vegetation during the egg-laying and incubation period are among the important factors influencing nest-site selection by prairie chicken hens.

6. Rabbit Management

J. A. Bailey, K. P. Thomas

Studies of nutrition of cottontail rabbits and of domestic rabbits (*Oryctolagus cuniculus*) have indicated that their digestive capacities are similar.

(1) Young cottontails starved when fed bluegrass exclusively, during summer (Monthly Wildlife Research Letter 8(8):4). In literature common to agriculturists and nutritionists, there are at least two reports of feeding trials in which domestic rabbits either died or lost weight on diets of bluegrass.

(2) In a study of reingestion, adult cottontails produced soft food pellets amounting to 30 percent of the total weight of both soft and hard pellets (MWRL 10 (8):3). This result was not significantly different from results obtained with domestic rabbits, as reported in two studies in the *Journal of Nutrition*.

(3) The abilities of six adult cottontails, weighing between 800 and 1,325 grams, to digest Purina Rabbit Chow were measured during January 1967. Quantities of food ingested and of feces produced (oven-dry weights) were determined during 6 days for three of the animals and during 3 days for the others. Coefficients of digestibility for dry matter in the feed were 66, 67, 71, 65, 63, and 70 percent for the six animals, respectively. The average digestibility, 67 percent, is comparable to the coefficient of 68 percent obtained for the same feed with domestic rabbits, as reported in the *Journal of Agricultural Research*.

These similarities between cottontails and domestic rabbits indicate the need for cognizance of literature that is seldom referred to in wildlife journals. Several reports in wildlife literature have stressed the importance of bluegrass as a cottontail food. None of th se reports have used the above-mentioned literature--outside wildlife journals--to question the value of bluegrass to cottontails.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | August, 1968 | Vol. 11, No. 8

1. Pheasant Populations and Land Use — S. L. Etter, R. E. Greenberg

During the summer of 1968, portions of nine harvested hayfields on the Sibley Study Area--comprising a total of approximately 48 acres--were searched for pheasant nests. Searches of these sample plots resulted in the location of 64 nests of which 13 (20 percent) were successful. Comparison of these data with the success rate (10 percent) of all nests found in harvested hay during the years 1962-67 indicated that nest success in harvested hay in 1968 was considerably higher than normal.

As a result of the high success rate of nests in harvested hay and the consequently lower rate of hen loss due to hay mowing, pheasant production during the nesting season of 1968 was considerably above average.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

Densities of pheasant nests in 1968 on seeded roadside plots (2.0 nests per acre) and on managed control roadside plots (1.4 nests per acre) represented the lowest rates of nest establishment on both types of plots during any of the past 6 years. Rates of nest establishment on seeded roadsides have varied from a low (previous to this year) of 2.1 nests per acre in 1967 to a high of 3.8 nests per acre in 1964. On managed control plots, nest densities have decreased each year since 1963, when 2.8 nests per acre were established. The establishment rate for managed control plots was 1.6 nests per acre in 1967.

Over the 6-year period, 306 nests have been established on seeded plots (2.7 nests per acre), compared with 208 nests on managed control plots (1.8 nests per acre).

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson, D. R. Vance

Eleven adult hen pheasants of game-farm stock were caged individually and examined daily from June to December, 1967, to determine more precisely the timing of the postnuptial molt of the primary feathers. The mean number of days between molting of successive primaries on the same wing generally increased as the molt progressed from the first (innermost) primary to the 10th (outermost) primary. The overall mean number of days between molting of successive primaries was 10.2 days, with a range of 7.5 to 12.9 days. This closely approximated the molt pattern established for juvenile pheasants, further substantiating the close relationship between the postnuptial molt of adult hens and the postjuvenile molt of their chicks.

It was also discovered that these hens tended to molt their left primaries

before molting the corresponding right primaries. In 74 percent of the cases, left primaries were molted first. Corresponding left and right primaries were molted at the same time in 23 percent of the cases and in only 3 percent of the cases did the right primaries molt first. No definite reason for this phenomenon was found. Whether wild hens show this pattern of molt is unknown.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis

Results of the prebreeding census in March 1968 indicated that quail densities on the Dale and Forbes areas were the highest ever recorded on the areas during the prebreeding periods, 1963-68. There were 9.4 quail per 100 acres on Dale and 8.2 quail per 100 acres on Forbes. The prebreeding populations in 1968 represented declines of 74 percent and 63 percent from the prehunt densities in 1967 on the Dale and Forbes areas, respectively. The overwinter losses in 1968 were comparable to the overwinter losses on the areas in 1967. Weather conditions during the winters of 1966-67 and 1967-68 were not considered unusually detrimental to quail.

In 1968, the overwinter survival rates of juvenile cocks were 1.6 (Forbes) and 1.8 (Dale) times those of adult cocks, and exceeded those of the preceding 2 years. We had previously thought that severe winters were associated with higher survival rates of juvenile cocks, compared with adult cocks, but possibly factors other than weather affect the differential rates of overwinter survival among age groups of quail on these areas.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

During the spring of 1968, 160 individuals assisted the prairie chicken research project with 161 man-mornings in blinds on booming grounds on the Bogota Study Area. Twenty-six groups and 14 mornings were involved during the period of mid-March to mid-April. Groups represented included the following: Northern Illinois University, 20 individuals; Eastern Illinois University, 19; Olney Community College, 13; Champaign County Audubon Society, 12; Champaign Centennial High School Conservation Club, 11; Indiana State University, Terre Haute, 9; Prairie Grouse Committee of the Illinois Chapter, The Nature Conservancy (PGC), 5; Great Lakes Chapter, Sierra Club, 4; Prairie Chicken Foundation of Illinois (PCFI), 4; St. Joseph's College, Rensselaer, Indiana, 4; Illinois Audubon Society, 4; Illinois Department of Conservation, 4; Illinois Natural History Survey, 3 (project leader not included); University of Illinois Agriculture Extension, 3; Indiana Izaak Walton League, 3; Crane Lake Game Preserve, 3; Peoria Journal Star, 2 (outdoor writer and photographer); University of Illinois, 1; plus 37 other ornithologists, sportsmen, and interested individuals.

All observers were briefed on what to look for and then directed into the blinds before the birds appeared on the booming grounds. After spending a minimum of 2 hours (longer if hens were present) in the blinds, observers were debriefed. Aside from enjoying viewing the courtship spectacle and being stimulated to help with the preservation of prairie chickens in Illinois, observers cooperated with the research project by recording their observations on standardized forms. A total of 41 morning records of booming activities were obtained for four of the six booming grounds present on the Bogota Area in 1968. In addition, two groups assisted with prescribed burning (Northern Illinois University) and prairie-plant seeding and transplanting (Champaign Centennial High School Conservation Club) on

several of the prairie chicken sanctuaries.

6. Rabbit Management K. P. Thomas

The harvest of cottontails on the Dale Area during the hunting season of 1967-68 was the lowest since 1964-65. In 1967-68, 185 rabbits were removed by hunters, a third of the number of rabbits killed by hunters during the previous season. Only 213 rabbit hunters were on the area in 1967-68; 361 hunter trips were made in 1966-67. Although a decrease in the hunting effort was partially responsible for the decrease in kill in 1967-68, the hunting success was reduced to 0.9 rabbit per trip, the lowest value recorded since 1963, and the kill of 0.3 rabbit per hour during 1967-68 was the lowest value so far recorded.

Both the burned zone (Zone I) and the food-patch management zone (Zone II) reflected the decrease in harvest. Although Zone I received 20 percent of the hunters on the Dale Area during the past two seasons, a 50 percent reduction in harvest on Zone I and a 70 percent reduction on Zone II occurred between the last two hunting seasons. The kill per hour was the same for both zones during 1967-68, but the kill per hunter was slightly higher on Zone I (1.02) than on Zone II (0.83). Hunters spent more time per trip on Zone I than on Zone II (3.6 vs 2.8 gun hours/trip, respectively). These factors indicate that field conditions may be more important than rabbit abundance in causing the differential reduction in harvest of the two zones during the past 2 years.

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MONTHLY WILDLIFE RESEARCH LETTER

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois — September, 1968 — Vol. 11, No. 9

1. Pheasant Populations and Land Use

S. L. Etter, R. E. Greenberg

The standardized counts of pheasant broods, made on the Sibley Study Area during July and August 1968, revealed 13 percent fewer broods than in 1967 and 10 percent fewer than in 1966. One hundred ten broods were observed along 640 miles of roadside transect (two 40-mile routes were driven weekly), compared with 127 broods in 1967 and 122 broods in 1966. The average size of broods judged to be completely counted was 5.0 chicks, compared with 5.6 chicks in 1967, a decrease of 11 percent.

The number of adult hen pheasants observed along these same 640 miles decreased from 214 in 1967 to 170 in 1968 (21 percent). Thirty-five percent of the adult hens observed in 1968 were broodless, compared with 41 percent in 1967.

The above indices, except the percentage of broodless hens, suggest a slight decrease in production in 1968, compared with 1967. Data obtained from nest searches, however, indicated a 14 percent increase in production in 1968, compared with 1967. Considering the small number of broods and of nests involved in the differences, it is felt that the reproductive success of pheasants was essentially the same in 1967 and 1968.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

In the last Monthly Wildlife Research Letter (Vol. 11, No. 8, August, 1968) it was reported that densities of pheasant nests this year on seeded roadside plots (2.0 nests per acre) and on managed control roadside plots (1.4 nests per acre) represented the lowest rates of nest establishment on both types of plots during any of the past 6 years. On seeded plots, however, successful nest production (hatched nests per acre) was the highest since 1965, while production on managed control plots was the lowest since 1965.

The density of successful nests on seeded plots was 0.8 nest per acre, and on managed control plots, 0.4 nest per acre; in 1967, the density on both types of plots was 0.5 hatched nest per acre. In previous years, on seeded plots, there were 1.1, 0.8, 0.8, and 0.7 nest per acre for 1963, 1964, 1965, and 1966, respectively; managed control plots had success rates for the same years of 0.5, 0.3, 0.4, and 0.6 nest per acre. Over the 6-year period, 87 nests have hatched on seeded roadsides (0.8 nest per acre), compared with 49 successful nests on managed control plots (0.4 nest per acre).

In 1968, 42 percent of the nests established on seeded plots were successful, the highest proportionate success of any year (1963-68). On managed control plots 30 percent of all nests hatched, which was the second highest proportionate success of the 6-year period.

3. Factors Influencing Distribution and Abundance of Pheasants   W. L. Anderson, D. R. Vance

The following report is the abstract from a manuscript entitled, "Metabolic reserves and organ weights of pheasants from good, fair, and poor range in Illinois." Most of the information was reported "piecemeal" in previous Monthly Wildlife Research Letters (see issues for March 1967, April 1967, and April 1968).

Seventy-five hen pheasants (58 juveniles and 17 adults) were captured on areas located near Sibley (good range), near Humboldt (fair range), and near Neoga (poor range) during October and early November, 1966, January 1967, and February 1968, and dissected. An additional 17 hens (all juveniles) were captured at Sibley and Humboldt during early November 1966 and January 1967, and experimentally starved. Hens from Neoga, when compared with hens from Sibley, had larger sternal muscles, leg muscles, ovaries, oviducts, and parathyroid glands, and smaller pancreases and adrenal glands (juveniles only). Hens from Humboldt exhibited fewer differences, having, on the average, larger sternal muscles, and smaller adrenal glands (juveniles only) than hens from Sibley. Mean weights of the entire body, fat strip, visceral fat, gizzards, hearts, kidneys, livers, lungs, spleens, thyroid glands, bursae, and thymus glands did not exhibit important area-to-area differences. The juvenile hens from Sibley that were experimentally starved survived an average of 8.8 days during November 1966, and 11.7 days during January 1967. Juvenile hens from Humboldt survived 8.8 and 11.5 days, respectively. The principle interpretations of these findings are: (1) pheasants in poor and in fair range possess quantities of metabolic reserves that are similar to, or greater than, those of birds in good range; (2) juvenile pheasants in fair range are as capable as pheasants in good range of surviving the stresses of starvation; (3) if weights of adrenal glands are reliable indicators of stress, juvenile pheasants in poor and in fair range are stressed less than juveniles in good range; and (4) the enlarged parathyroid glands in birds from Neoga constitute clinical evidence that pheasants in poor range utilize less calcium than pheasants in fair and in good range.

4. Responses of Bobwhites to Habitat Manipulation   J. A. Ellis, P. J. Matthews

We have used counts of whistling bobwhites along standardized routes on the Forbes and Dale areas for the period May 15-July 15 as indices of fall population densities (Monthly Wildlife Research Letter 10(9):2). The average number of calls rather than the average number of whistling cocks, per listening stop, has more accurately predicted the fall populations on both areas.

For 1968, the average number of calls per stop on Forbes (25.4) indicated that the fall population will be 32.7 quail per 100 acres. This population estimate was 25 percent greater than the population estimate obtained by the same method in 1967. On Dale, the predicted prehunt population in 1968 will be 33.4 quail per 100 acres, compared with 38.4 quail per 100 acres in 1967, a decrease of 13 percent.

5. Responses of Prairie Chickens to Habitat Manipulation   R. L. Westemeier

The distribution of booming grounds, prairie chicken hens, and nests on the Bogota Study Area in 1968 indicates that the prairie chicken sanctuaries are now

playing the major role in supporting the flock(s) at Bogota. Of the six booming grounds established at Bogota this spring, three were located on sanctuaries, two were within 100 yards of sanctuaries, and one was about 900 yards from the nearest sanctuary. The latter ground (Kellog), one of the major traditional booming grounds on the area, was occupied by seven cocks as early as January 1968 but declined to three cocks during the main courtship season of mid-March to mid-April. Only one hen was seen visiting the Kellog booming ground. By contrast, the highest counts of hens on the other five grounds were: Zimmerman, 10; J. Woods, 10; Donnelley East, 8; Yeatter, 5; and Donnelley North, 3. These counts, totaling 37 hens, were made by observers in blinds, on different mornings, and very likely involve duplications. The highest total count of individual hens made on one morning was 18. The amount of shuttling between booming grounds by either sex remains unknown, with the absence of marked birds.

However, the highest winter count of 72 birds (both sexes) made January 10, 1968, is in close agreement with the possible total of 74 individual prairie chickens seen during the booming season. The highest count of cocks seen on one morning during the main booming season was 37. Thus, these observations indicate that a nearly equal number of hens was present on the Bogota Area this spring.

The locations of 21 prairie chicken nests were subsequently learned through systematic searches of the sanctuaries (18 nests) and through reports by local residents (3 nests--on private land). Hatching success was 72 percent on the sanctuaries and 33 percent on private land, based on the above samples. The overall hatching success of 67 percent in 1968 is substantially better than the average hatching success of 41 percent for the period of 1963-67. It seems reasonable to assume that the 18 nests on sanctuaries in 1968 represent between one-half to two-thirds of the total nesting effort by the hen population on the Bogota Area--the highest proportion since land acquisition began in 1962.

6. Rabbit Management

K. P. Thomas

During the hunting season of 1967-68, 587 rabbits were harvested on the Forbes Area by 319 hunters who sought cottontails exclusively. Although 139 hunter-trips were made in 1966-67, these hunters bagged only 142 rabbits, or 1 rabbit per trip, compared with the harvest of 3 rabbits per trip in the 1967-68 season. The increase in hunter success from the hunting season of 1966-67 to that of 1967-68 was 0.3 to 0.5 rabbit per hour, respectively. These data indicated an increase in the rabbit population on the Forbes Area in 1967.

During the season 1967-68, hunters bagged 174 rabbits on the sharecrop-burn management zone (Zone 1) on Forbes. The hunters saw an average of 7.1 rabbits and remained in the field an average of 4 hours. Zone 1 (250 acres) was hunted an average of 6 hours per day during the 75-day rabbit season. Despite this heavy hunting pressure, hunters bagged 1.6 rabbits per trip and 0.7 rabbit per acre, exclusive of the harvest of rabbits taken by hunters seeking rabbits and quail.

On September 16, Mr. George B. Rose was employed on this project to conduct the population ecology phase of the study. Mr. K. P. Thomas will continue to study the ecology of cottontails in relation to secondary succession.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | October, 1968 | Vol. 11, No. 10

1. Pheasant Populations and Land Use

S. L. Etter, R. E. Greenberg

Analysis of the mean number of pheasant chicks in broods judged to be completely counted along roadside transects in July and August during the period 1962 through 1968 revealed significant differences ($P = < 0.025$) in observed brood sizes among years. Higher than average brood sizes were observed in 1962 and 1967 (5.5 and 5.4 chicks, respectively) while lower than average brood sizes were observed in 1963 and 1964 (4.5 and 4.3 chicks). Observed brood sizes in 1965, 1966, and 1968 (5.1, 5.1, and 4.9 chicks) were near the average for the 7-year period.

The percentages of broodless hens observed along the same transects in August during these years also showed significant differences among years ($P = < 0.01$). Lower than average percentages of broodless hens were observed in 1962, 1967, and 1968 (7, 20, and 21 percent, respectively) and higher than average percentages of broodless hens were observed in 1963, 1964, and 1966 (39, 35, and 32 percent). The percentage of broodless hens in 1965 (26 percent) was near the average for the 7-year period.

While the percentage of broodless hens in August is an index only to the reproductive success of hens surviving to that time, the above data suggest that the average number of chicks per brood is greater during years when the proportionate reproductive success of breeding hens is high than in years when proportionate reproductive success is low. Consequently, it appears that population indices should take into account differences in brood sizes as well as in numbers of broods in order to reflect more precisely the magnitude of population changes among years.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

Seeding of the Ford County Management Unit was accomplished between August 20 and September 4. Of the 65 farm operators having acreage on and abutting the 16-square-mile area, 61 cooperated in the program. The 61 cooperators accounted for 73 of the 81 miles (90.1 percent) and 149.2 of the 165.2 acres of roadside (90.3 percent) on the management area. Approximately 56 of the 81 miles (115.2 acres) were completely seeded; 7 miles (14.4 acres) were seeded in part, and in part designated for nitrogen application because of good stands of brome grass. Slightly over 10 miles (19.6 acres) are to receive nitrogen during spring, 1969, and were not seeded. Roadsides of the four noncooperating farmers totaled 8 miles (16 acres).

Six phases of activity were involved in the seeding operations: (1) fertilizer

application, (2) lime application, (3) mowing, (4) chemical application, (5) seeding, and (6) rolling. Fertilizer (P_2O_5) was applied at a rate of 90 pounds per acre, and lime at 5^+ tons per acre. Close-crop mowing of roadsides to be seeded was undertaken to make the chemical defoliate more effective and for efficient operation of the seeder. The chemical defoliate, Ortho Paraquat, was applied to retard existing vegetation until the seeded species could get a start. Brome grass (Bromus inermus) and Vernal alfalfa (Medicago sativa) were seeded at a rate of 12 pounds per acre each. After seeding, the roadsides were rolled with Brillion rollers to compact the seed-bed.

All operations during the seeding phase of the project (including miscellaneous activities and supervision) totaled 440 man-hours, or 3.3 man-hours per acre and 6.7 man-hours per mile. Another 220 man-hours were involved in the planning and preseeding phases.

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson, D. R. Vance

As in previous years, hen pheasants were collected during May and June, 1968, in Ford and Livingston counties, and were dissected to determine, among other things, the reproductive status of pheasants during the laying and incubating periods. Counts of ruptured follicles in ovaries of 11 laying hens indicated that hens began laying, on the average, on April 26 (range, April 12-May 10). These dates were estimated by allowing 1.3 days for each egg (ruptured follicle) laid. An average of 29.9 ruptured follicles was found in 11 incubating hens, which suggests that hens laid, on the average, 30 eggs before beginning to incubate. In 1966, it was estimated that hens began laying, on the average, on April 30 (range, April 18-May 9) and laid an average of 34 eggs before incubation began. In 1967, the average date for beginning of laying was April 26 (range, April 10-May 15) and an average of 31 eggs were laid before incubation began. These findings suggest that onset of laying and the subsequent number of eggs laid by hens in the state's better pheasant range are markedly similar from one year to another.

4. Responses of Bobwhites to Habitat Manipulation — J. Ellis, P. Matthews

A statistical correlation was found between mean covey size and fall population (quail) during the prehunt periods 1963-67 on the Dale and Forbes areas. During this period, mean covey size ranged from 13.7 (Forbes 1965) to 17.4 (Dale 1967) and fall densities ranged from 9.4 quail per 100 acres (Forbes 1965) to 36.4 quail per 100 acres (Dale 1967). A correlation value significant at the 1 percent level was demonstrated on the Dale Area; 96 percent of the changes in mean covey size on this area could be explained by changes in population density. This relationship also existed on the Forbes Area at the 5 percent level of significance; 75 percent of the changes in mean covey size could be explained by changes in population density. These data indicate that mean covey size in fall is influenced by population density in addition to environmental and to other population factors.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

During the 6-year period of 1963-68, prairie chicken nests have been verified in 11 general cover types on the Bogota Study Area. Nest densities (nests per 100 acres) averaged 4.9 in 265 acres of timothy, 6.2 in 732 acres of redtop, 7.9 in 138 acres of mixed redtop and timothy, 10.3 in 39 acres of weedy grasses and forbs, and 11.1 in 18 acres of weedy legumes, all of which were systematically searched on foot. Although only two nests have been found in 370 acres of mixed wheat stubble-legumes, nests commonly are destroyed by spring plowing of this cover type, according to local residents. Thus, under present Illinois conditions five or six cover types might be considered as preferred nesting cover.

Since most nests occur within $\frac{1}{4}$ mile of booming grounds, a better approach to determining nesting preferences is to study nest locations in relation to (1) the types of cover available in fields beginning within $\frac{1}{4}$ mile of booming grounds and (2) the number of hens seen on each respective booming ground. For example, a maximum count of 10 hens was made in 1968 on the booming grounds at the center of the 140-acre Zimmerman tract. Nest densities (nests per 100 acres) in the cover surrounding the Zimmerman booming ground were: redtop, 4.7 (2 nests in 43 acres); timothy, 9.1 (2 nests in 22 acres); and weedy grass-forb-legume mixtures, 11.1 (3 nests in 27 acres). Similar patterns of preference by nesting hens were noted for cover near the other three major booming grounds at Bogota in 1968.

Redtop is popularly considered the best type of nesting cover for prairie chickens in south-central Illinois, and although the highest density of nests (8 nests in 19 acres in 1964) so far documented was in redtop with a red clover admixture, the data presented indicate that other types of cover are more readily accepted if available. Redtop has the additional disadvantage of being most attractive to nesting hens only during its second and third growing seasons, after which nest densities decline to a low level.

6. Rabbit Management — K. P. Thomas

Although the primary purpose of nightlighting operations on the Forbes Area has been to collect quail, the operation may be of value as an index to trends of the population of rabbits on the area. Counts made prior to 1967 were conducted in abandoned pastures and fields and ranged from 7.1 rabbits per hour in 1965 to 8.5 rabbits per hour in 1966.

In 1967 and 1968, nightlighting on Zone 1 (sharecrop-burn zone) was limited to small-grain stubble fields. In 1967, 106 rabbits were seen during 8.2 hours of nightlighting or 13.0 rabbits per hour; whereas 120 rabbits were observed in 8.92 hours (13.5 rabbits per hour) during 1968. Eighty-four acres were covered in 1967 (1.3 rabbits per acre) and 76 acres in 1968 (1.6 rabbits per acre). If nightlighting can be used as an index to the number of rabbits on the Forbes Area we would expect the population to be above that of last year and a harvest approaching 1 rabbit per acre on Zone 1.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois November, 1968 Vol. 11, No. 11

1. Pheasant Populations and Land Use

S. L. Etter, R. E. Greenberg

During the period 1962-68, 121 nests which hatched in June and July were located by systematic nest searches. The mean number of chicks that hatched in 84 nests, in June, was 9.4, significantly greater ($\underline{P}$=<0.005) than the mean number of chicks in the clutches that hatched in July--7.6.

The sizes of completely counted broods observed along roadside transects indicated that brood size, also, differed according to the month of hatch. During the period 1962-68, complete counts were obtained for 189 broods which were 3 to 6 weeks old at the time of observation. The mean number of chicks in 125 broods that hatched in June (5.6) was significantly greater ($\underline{P}$=<0.025) than the mean number of chicks in 64 broods that hatched in July (4.7).

These data suggest that the differences in observed brood sizes during the past 7 years (MWRL 11(10):1) resulted primarily from differences in the chronology of hatch among years.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

Total cost of manipulation of roadside cover on the Ford County Management Unit (MWRL 11(10):1) is estimated to be \$10,124. Seedings cost \$9,650, and nitrogen fertilization, \$474. The 81 miles of roadside within and abutting on the management unit are the equivalent of roadsides around $20\frac{1}{4}$ sections of land. Thus, the cost of treatment came to approximately \$500 per square mile.

Material for seeding operations cost \$5,929; costs for application of materials and for operations not utilizing materials (e.g., mowing) totaled \$3,721. The cost and application of limestone and fertilizer (\$4,249) was by far the greatest segment of total seeding expenses (44 percent). Seed accounted for 17 percent of the total seeding costs, and the chemical defoliate, 10 percent. Mowing, rolling, and miscellaneous activities accounted for 4-5 percent of the total cost of seeding. Supervisory expenses were about 16 percent of this total.

On a unit area basis, costs for all material and operations on the management unit averaged \$68 per acre and \$139 per mile of roadside (one side of road only).

Seeding operations cost about $78 per acre or $154 per mile; application of nitrogen fertilizer cost $18 per acre or about $28 per mile. Fertilizer and lime for seeding operations cost nearly $35 per acre or $68 per mile. Seed costs and application came to $14 per acre of $27 per mile.

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson, D. R. Vance

The mean weight of seven adult hen pheasants collected in Ford and Livingston counties during October 1968 was 924 g. This compares favorably with the mean weights of adult hens collected during the same period in 1966 (901 g) and 1967 (901 g). The mean weights of muscle groups and of fat deposits of the hens collected in 1968, relative to those of the hens collected in 1966 and 1967, respectively, were: sternal muscles, 102 and 102 percent; leg muscles, 101 and 100 percent; fat strip, 275 and 183 percent; visceral fat, 436 and 321 percent. These findings indicate that adult hens in the state's better pheasant range were in better physical condition during the postnesting period in 1968 than during the same period in the 2 preceding years.

4. Responses of Bobwhites to Habitat Manipulation — J. Ellis, P. Matthews

One of the non-"Smokey Bear" type of problems associated with the burn programs on the Dale and Forbes areas has been the establishment of firebreaks. During the fall, we have plowed around the sites scheduled for burning the following spring. Although plowed strips 4-6 feet wide are adequate firebreaks, the "dead furrows" tend to erode in certain topographic situations, creating small ditches.

To overcome this problem of erosion, we have contrived a tractor-drawn machine that will establish firebreaks by burning. The machine consists of a 150-gallon orchard sprayer, to which we attached three propane burners of the type used for burning alfalfa fields, and a spray system behind the burners to extinguish the outside flames. Preliminary testing of the machine indicates that it can be used to establish adequate firebreaks: the best method includes burning firelanes around the chosen sites in June or July. Burns at this time will kill the vegetation. A later burn in September over the same firelanes will eliminate the vegetation completely, leaving the firelanes bare surrounding burns initiated in the fall or the subsequent spring.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

In the last report (MWRL 11(10):3) it was shown that timothy and weedy grass-forb-domestic legume mixtures, if available near booming grounds, are more readily accepted than redtop by nesting prairie chickens. During the 6-year period of 1963-68, 84 prairie chicken nests were examined, and the dominant plants at the nest sites were compared with the dominant cover in the fields which contained the nests.

Only 14 percent of 42 nests found in fields dominated by redtop were situated in 100 percent redtop; 67 percent of the nests were located in redtop with an admixture of one or more other species; and 19 percent were in vegetation containing either insignificant amounts of redtop or none at all. In fields dominated by timothy, however, 83 percent of 12 nests were situated in 100 percent timothy; nest sites of the remaining 17 percent had an admixture of one or more other species. Timothy, a bunchgrass which resembles the native prairie grasses to a greater degree than redtop, may be preferred to redtop. With the exception of timothy, it appears that nesting hens seek situations of diverse cover within fields that are generally monotypic. Current efforts to establish and maintain nesting cover on prairie chicken sanctuaries in Illinois are aimed at providing more diverse cover types (especially semi-natural prairie) than are possible with pure redtop seedings.

6. Rabbit Management

K. P. Thomas

During the fall of 1968, 239 captures of rabbits were made on the sharecrop-burn zone (Zone 1) of the Forbes Area. The cover type adjacent to each capture site was noted to establish the cover types preferred by cottontails.

The trapline was approximately 4 miles long, with nonbaited traps located about 50 yards apart. Brush bordered at least one side of 3 miles of trapline; approximately 0.6 mile of the brush was burned during 1967. Captures adjacent to nonburned brush totaled 132 (5.6 captures per mile), and 105 adjacent to burned brush (16.7 captures per mile). Cottontails were apparently more abundant in proximity to the burned brush than to the nonburned brush.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois December, 1968 Vol. II, No. 12

1. Pheasant Populations and Land Use S. L. Etter, R. E. Greenberg

From 1962 through 1964, a total of 1,190 juvenile cock pheasants were captured by nightlighting, marked with back tags and bands, and released on the Sibley Study Area during the period October 1-November 11. Of these marked juveniles, 476 (40 percent) were shot during the following hunting seasons. The proportion of marked cocks that were killed differed considerably in relation to the dates on which they were tagged. Of 502 cocks marked during the first trapping period (October 1-21), only 171 (34 percent) were shot, compared with 305 (44 percent) of 688 cocks marked during the last trapping period (October 22-November 11). Statistical analysis of these data indicated that the observed differences were highly significant ($\underline{P} = <0.01$). Data for individual years were consistent with the combined data, but the sample sizes were too small to demonstrate statistical significance.

The above data indicate that a significant mortality of juvenile cock pheasants occurs before the opening of the hunting season. Based upon the figures reported, an estimated 23 percent of the juvenile cock pheasants alive at the midpoint of the first trapping period fail to survive until the midpoint of the second trapping period. Assuming that this mortality rate remains constant until the beginning of the hunting season, it appears that as many as 40 percent more cock pheasants would be available to hunters if the hunting season began in mid-October rather than in mid-November. While a mid-October opening of the pheasant season in Illinois is unrealistic because of large acreages of standing corn, these findings strongly suggest that the pheasant season should begin on the earliest date permitted by existing agricultural practices.

2. Manipulation of Pheasant Habitat G. B. Joselyn

It might be argued that the cost of manipulating roadsides on the Ford County Management Unit ($10,124 total; $68 per acre; $139 per mile) relative to the size of the area treated is excessive. Only a small segment of Ford County, about 4 percent, was included in the treated area and treatment was applied to only 1.2 percent of the land area on the management unit. Projecting the cost of this seeding to the remainder of Ford County would approximate a quarter of a million dollars. However, there is reason to believe that bromegrass seedings, once established, will serve as high-quality pheasant nesting cover for more than 10 years. Seedings established on the Sibley Study Area in 1962 show no perceptible signs of being less valuable as pheasant nesting cover 6 years later. Thus, when amortized over a 10-year period, the $68 per acre cost of roadside treatment on the Ford County Management Unit comes to about $7 per acre per year. A program of leasing private farmland in the same area and in most of the Illinois prime pheasant range would cost $50-$60 per acre per year, plus seeding costs. Thus, roadsides can be manipulated at about one-seventh, or less, of the cost of attempting to provide nesting cover on private agricultural land.

It cannot be stated that this one pilot project shows beyond any doubt that roadside seedings undertaken on a large scale are economically justified, but rather that they cannot be ruled out as a possible and feasible method of establishing nesting cover for pheasants.

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson, D. R. Vance

The possibility that a deficiency or excess of some mineral might be limiting the distribution of pheasants has been the subject of intensive investigation during the past 2 years. Hen pheasants were collected from three areas--located near Sibley (good range), Humboldt (fair range), and Neoga (poor range), respectively--during October 1966, and January 1967, and dissected. Tissues and organs from these birds, plus samples of soil, grit, corn, and soybeans from each area, were analyzed for concentrations of 25 elements. The results of this work indicated that the inorganic chemistry of the environment and of pheasants differs greatly between poor range and good range. Of the elements studied, suspicion was directed toward six (calcium, magnesium, potassium, chromium, cobalt, and molybdenum) as possibly influencing the distribution and abundance of pheasants in Illinois.

To obtain additional information on possible relationships between minerals and pheasant distribution, a second investigation was initiated in 1968. Ten juvenile hens and 10 samples of soil were collected at Sibley and at Neoga during February. Blood, livers, gizzard linings, gizzard muscles, hearts, kidneys, lungs, pancreases, and spleens from these birds, plus grit from the soil samples, were analyzed for concentrations of 5 major elements and 57 trace elements. The samples of grit, blood, and livers were analyzed individually; the other internal organs were pooled according to type of tissue before being analyzed. Preliminary examination of the data have revealed that concentrations of many elements in the grit and in pheasant organs from Neoga differ appreciably from those from Sibley. In grit, 29 elements were present in concentrations above their lower limits of detection; of these, approximately 11 appeared to be more abundant, and 7 less abundant, in samples from Neoga than in samples from Sibley. In pheasants, mean concentrations of all five major elements (calcium, magnesium, phosphorus, potassium, and sodium) were less in livers from Neoga birds than in livers from Sibley birds; the differences for calcium and sodium were significant at the 99.9 percent level. Many more differences, Neoga versus Sibley, will undoubtedly become apparent when statistical analysis of the data is completed.

4. Responses of Bobwhites to Habitat Manipulation — J. Ellis

During the past 3 summers, approximately 2,090 quadrat samples of vegetation were made on the Dale and Forbes areas to determine the vegetative responses to burning and cropping practices in the experimental management zones. These 1/16-square-meter quadrat samples were made in open nontimbered fields 6 or 18 months after burning or sharecropping. The open fields are an important component of the bobwhite's habitat because they provide nesting and roosting cover and food.

The most frequently occurring plants after the burning or sharecropping were goldenrod (*Solidago* spp.), rough buttonweed (*Diodia teres*), fall white aster (*Aster pilosus*), common tickle grass (*Agrostis hyemalis*), Korean lespedeza (*Lespedeza stipulacea*), common and lance-leaf ragweed (*Ambrosia artemisiifolia* and *A. bidentata*),

rushes (Juncus spp.), and beggar-ticks (Bidens spp.). These plants represent the early seral stages of plant communities in this general area. The abundance of these plants varied according to site location and soil fertility. Within this group of plants are annuals and perennials, and, with the exception of Korean lespedeza, all are native to the area. Korean lespedeza and common ragweed are important quail foods.

The amount of bare ground in this early seral stage (6 to 18 months after burning or sharecropping) ranged from 15 to 36 percent. The amount of bare ground tended to decrease as the age of the plant community increased. Thus, the life-forms of these plants created a situation that tended to be open underneath, with some canopy cover. In these early seral stages, quail could move freely, have a limited amount of protective cover, and find food.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

At Bogota during the 6-year period of 1963-68, distances between 84 prairie chicken nests and the estimated centers of the nearest booming grounds have ranged from 117 to 1,700 yards, with a median distance of 360 yards. Seventy-four percent of the 84 nests were within 175 yards of this median distance; thus, most nesting occurred within zones about 350 yards wide, encircling booming grounds. It also appears that hens prefer to nest at least 120 yards from booming grounds.

The Zimmerman booming ground in 1968 presented the only instance during the 6-year period where nesting cover completely encircled a booming ground. Although prairie chicken hens could have nested up to 660 yards from the estimated center of the Zimmerman booming ground, six nests were found at distances ranging from 210 yards to 254 yards; a seventh nest was 323 yards from the booming ground. On this basis the preferred zone for nesting may be in closer proximity to booming grounds than is indicated by the pooled data for all 6 years.

Two management implications are suggested by these data: (1) the "no nest space" with a radius of about 120 yards from booming ground centers indicates that suitable sites for booming should be at least 10 acres in size; and (2) although prairie chickens will shift booming locations from year to year, cover should be established at distances ranging from 200 to 500 yards of traditional booming grounds to best meet nesting requirements. Provision of suitable booming sites (by burning, mowing, or soil tillage) is desirable on management tracts of over 40 acres.

6. Rabbit Management — K. P. Thomas

Bailey (1967. MWRL 10(7):3) reported that the condition index $\left[\frac{(\text{weight}-16)\text{ g}}{\text{length}^3\ (\text{dm})}\right]$ for 499 cottontails collected on the Allerton Park 4-H Area or on the University of Illinois farms near Urbana, Illinois, was 5.48. A condition index higher than 5.48 indicated that the rabbits were heavier than average in respect to their total length.

The weights and lengths of 187 rabbits taken during trapping and nightlighting operations on the sharecrop-burn management zone on the Forbes Area in 1968 between late September and early November were used to compute a condition index.

The condition index for the rabbits collected on Zone I was 6.16; thus, these rabbits were apparently in good physical condition.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois January, 1969 Vol. 12, No. 1

1. Pheasant Populations and Land Use S. L. Etter, R. E. Greenberg

A preliminary estimate of the harvest of cock pheasants on the Sibley Study Area, based on changes in the sex ratio, indicates that 54 percent of the available cocks were killed during the hunting season of 1968. According to this estimate, a greater proportion of the available cocks were killed in 1968 than in 1965, 1966, or 1967, when the estimated harvests were, respectively, 30, 50, and 28 percent of the available cocks. The 1968 figure, however, was considerably lower than the estimated harvests in 1962, 1963, and 1964, when 74, 65, and 75 percent of the available cocks were killed.

These data suggest that the extended hunting season in 1968 resulted in only a slight increase in harvest rate compared with that of 1966, when hunting conditions and population levels were similar. Although the harvest rates in 1962, 1963, and 1964 are not directly comparable with that in 1968 because of the three-cock bag limits in effect during those years, these data suggest that high harvest rates can occur only at high population levels. In light of these findings, continuation of the longer pheasant seasons in future years appears to be desirable.

2. Manipulation of Pheasant Habitat G. B. Joselyn

In 1967 and 1968, spring (May) roadside counts of pheasants and summer (August) brood counts were conducted on the Ford County Management Unit and on portions of the Sibley Study Area. Data from these counts will be used to evaluate pheasant population changes on the management unit in years subsequent to the seeding of roadsides. Spring roadside counts covering 40 miles were made on the Ford County unit and on the Sibley Study Area (control) on 5 mornings in 1967 and 4 mornings in 1968. Counts were made with two trucks (one truck on each area) driving approximately 20 miles per hour and were begun 1 hour after sunrise. Only those pheasants observed on or within 100 yards of the roadway were recorded.

For brood counts, a control area was chosen that included the 9 Sections comprising the southwest quarter of the Sibley Study Area, and 8 adjoining Sections south and west of the study area. These counts, which covered 20 miles, were also started 1 hour after sunrise and had one truck on each area driving about 20 miles per hour. Only those broods appearing within the roadway right-of-way lines were counted. In 1967, counts were made on each route on 16 mornings between August 1 and 25; in 1968, counts were made on each route on 8 mornings between July 30 and August 9.

Data from both spring roadside and summer brood counts indicate that the Ford County Management Unit in both 1967 and 1968 had a greater population of pheasants than the Sibley Study Area and adjacent Sections included in the routes. The Ford County unit had 1.9 and 2.9 pheasants per mile in May of 1967 and 1968, respectively, while the Sibley Study Area had 1.1 and 2.4 birds per mile for the same years. Brood

counts showed an even greater difference--routes run on the Ford County Management Unit showed about three times the number of broods as on the Sibley Study Area.

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson, D. R. Vance

It was reported in the preceding research letter (MWRL 11(12):2) that samples of grit and pheasant tissues from Sibley (good pheasant range) and from Neoga (poor range) have been analyzed for concentrations of 62 chemical elements. For grit, statistical analyses of the data reveal that mean concentrations of nine elements exhibit significant differences, Neoga compared with Sibley. Of these, two (potassium and sodium) were less abundant, and seven (barium, cobalt, iron, gallium, lanthanum, manganese, and nickel) more abundant, in Neoga grit than in Sibley grit. As it is reasonably well established that grit is a major source of minerals for pheasants, these findings indicate that the mineral intake by birds in good range and in poor range probably differs appreciably. It is especially noteworthy that, in grit from Neoga, the number of elements present in potentially excessive quantities is considerably greater than the number present in potentially deficient amounts.

4. Responses of Bobwhites to Habitat Manipulation — J. Ellis, P. Matthews

Results of the prehunt censuses conducted on the Dale and Forbes areas during early November 1968 revealed the highest quail population densities since the initiation of this study. On Dale, 27 coveys with 485 quail (44 birds per 100 acres) were located. This prehunt population in 1968 represented an increase of 21 percent over the prehunt population in 1967 (36 birds per 100 acres). On Forbes, 535 quail in 35 coveys (23 birds per 100 acres) were located, an increase in population density of only 2 percent from 1967 to 1968.

Quail density on the experimental management zone on the Dale Area increased 30 percent from the level in 1967, 52 birds per 100 acres to 67 quail per 100 acres in 1968. The only management technique used in this zone on the Dale Area was prescribed burning. On Forbes in 1967 and 1968, the population density on the experimental management zone remained at 95 birds per 100 acres.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

During the 6-year period of 1963-68 at Bogota, data have accumulated which indicate the limitations in spacing that nesting prairie chickens will tolerate. Measurement of distances between 65 nests and their nearest neighboring nests in contiguous nesting cover revealed a median distance of 107 yards. The minimum distance of 17 yards between nests involved one nest destroyed by predation and one hatched nest, which may represent the effort of a single hen. Although two hatched nests were found (July 5, 1963) as close as 30 yards, these nests may not have been active simultaneously.

A tolerance limit of approximately 120 yards was suggested by plotting the 65 distances in relation to hatching success. Considering only the hatched nests and the nests destroyed by predation, 44 percent of 34 nests located closer together than 120 yards were lost to predation, whereas 16 percent of 31 nests located over 120 yards apart were destroyed by predators. Seventy-five percent of all predation occurred when inter-nest spacing was less than 120 yards. Further, five lone nests in isolated fields of nesting cover successfully hatched; many such "no-neighbor" nests at Bogota have been destroyed by farming activities but none have been verified

as losses due to predation. If the 120-yard distance is the saturation point of nest density, predation is chiefly a function of supersaturation of available nesting territories. A partial explanation for this phenomenon may be that hens whose nests are destroyed select a renesting site less than 120 yards from the original nest site.

6. Rabbit Management

K. P. Thomas

During the fall of 1968, rabbit traps were placed along the field edges of Zone I (sharecrop-burn) on Forbes. Plotting the capture sites along the trapline revealed that some areas produced several rabbits, whereas other sections of the trapline produced very few. In general, rabbits were taken more frequently on borders which contained brush than on open areas.

Plots of the locations of quail coveys found during the fall of 1968 correspond to the portions of the trapline where few captures of rabbits were made. These borders were generally characterized by an abrupt change from trees or brush to open fields. Although Zone I has had relatively high populations of quail and rabbits during 1967 and 1968, the two species seem to have distinct habitat preferences.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | February, 1969 | Vol. 12, No. 2

1. Pheasant Populations and Land Use

S. L. Etter, R. E. Greenberg

To determine the distribution of hunting effort and kill during the pheasant hunting season in 1968, questionnaires were sent to 199 hunters who responded to similar questionnaires in 1967. Responses to the questionnaires sent to hunters in 1968 totaled 139 (70 percent). Of the respondents, 32 (23 percent) reported that they did not hunt pheasants in 1968. The 107 respondents who hunted pheasants in both 1967 and 1968 reported a total hunting effort of 810 days in 1968, a decrease of 8 percent from the 882 days reported in 1967. Their reported kill in 1968 was 672 cocks, compared with 509 cocks in 1967 -- an increase of 32 percent.

Thirty-two percent of the reported hunting effort and 34 percent of the reported kill in 1968 occurred during the last 16 days of the 45½-day season. In 1967, 29 percent of both the reported hunter-days and the kill occurred during the 14-day season extension which followed the regular 29½-day season. With the additional 2 days of the 1968 season taken into account, the proportionate hunting effort during the latter part of the season was essentially equal in 1967 and 1968. The proportion of the reported kill that occurred during the latter part of the season in 1968 was slightly higher than that in 1967, even when the 2 additional days were considered.

These data indicate that hunters have responded favorably to the longer hunting seasons by taking advantage of the additional opportunity for hunting. However, the hunting that occurred during the period provided by the longer season in 1968 cannot necessarily be considered as additional to the hunting that would have occurred during a shorter season. Hunting trips during the latter part of the longer season may have substituted for earlier trips rather than representing an increase in the total number of hunting trips. Consequently, data from earlier years would be necessary to determine whether the longer seasons have actually resulted in a significant increase in total hunting effort.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

The ultimate success of the roadside seedings on the Ford County Management Unit may to a great extent be determined by the growth of the seedlings between the time of planting late last summer and the end of the growing season in mid-October. Precipitation is the most important factor in the early growth stage of the seedings. Rainfall at Gibson City (near the Ford County Management Unit) was normal or above normal during the spring and summer months, resulting in the presence of adequate subsurface moisture when the seeding operations began on August 13; however, a period of hot dry weather began at almost the same time.

From August 11 to 31 only 0.50 inch of rain was recorded at Gibson City, and from September 1 to 16 only 0.32 inch of rain fell. Rainfall during these months was scattered and light, over several days, and was inadequate to start the seed growing. During the period September 17-30, 2.60 inches of rain fell, distributed over 6 days, which resulted in sprouting of alfalfa on many of the roadsides. However, October had less than an inch of rain for the whole month (0.62), over 2 inches below normal. Rainfall during the combined months of August, September, and October was 4.45 inches below normal, or only about 55 percent of normal precipitation for those 3 months.

This lack of moisture could jeopardize the success of the seedings, although adequate spring rainfall could help to improve seedling vigor.

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson, D. R. Vance

It was reported in the December 1968 research letter (MWRL 11(12):2) that selected tissues from juvenile hen pheasants collected at Sibley (good range) and at Neoga (poor range) had been analyzed for 62 chemical elements. Twenty-three of these elements were present in detectable concentrations in the pheasant tissues. Statistical tests indicated that mean concentrations of eight elements in livers and one in blood differed significantly, Neoga hens compared with Sibley hens. Four of these (calcium, sodium, and lead in livers, and copper in blood) were less abundant, and five (aluminum, barium, strontium, titanium, and zirconium, all in livers) were more abundant in hens from Neoga than in hens from Sibley. On the basis of this information, plus published knowledge of the behavior of elements in biological systems, the pheasants from Neoga were possibly subjected to deficiencies of calcium and copper, and to excesses of barium and strontium.

4. Responses of Bobwhites to Habitat Manipulation — J. Ellis, P. Matthews

Age and weight data collected from quail on the Forbes Area during 1966-68 were analyzed to determine the growth rate of quail on that area. A sample of 277 quail representing birds trapped in the fall and birds collected during the hunting season were used to plot a growth curve. The quail were aged to the nearest week by wing-molt criteria. Because individuals under 4 weeks did not occur in the sample, the age period represented was from 4 to 22 weeks.

The quail demonstrated a remarkably constant rate of weight increase from 4 to 10 weeks of age, averaging 12.5 grams increase per week, with an average standard deviation of 8.6 grams from the mean weight for each respective week. Thus, from 4 to 10 weeks of age, quail were aged to within 1 week of accuracy by weight alone.

A deflection in the growth rate of the quail occurred at 10 weeks of age and remained fairly constant until 13 weeks, a gain of 5.1 grams per week. The average standard deviation from the mean weight for each respective week was 9.7 grams, indicating too much variation to age birds accurately. At 14 weeks the mean weight was 13 grams less than the mean weight at 13 weeks. The significance of this loss was not known. From 16 to 22 weeks the growth rate was virtually constant, 1.6 grams/week -- a low rate of increase -- until the mature weight was reached.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

It was reported in the preceding research letter (MWRL 12(1):2) that the tolerance limit in nest spacing of prairie chickens appears to be about 120 yards, judged on the basis of hatching success. Seventy-five percent of 20 nests destroyed by predation at Bogota had a nearest-neighbor spacing of less than 120 yards.

The spacing between nests in relation to the clutch size of nests provides additional evidence that nesting prairie chickens require a certain amount of space for maximum efficiency in production. Clutch sizes of 15 nests increased as the nearest-neighbor spacing between nests approached 120 yards ($r = 0.595$, $P < 0.05$); 23 nests separated by greater distances showed no apparent change in clutch size. Interpretation of these data is complicated by insufficient information on (1) the time when the nests were initiated and (2) by the possibility of renesting. However, the prairie chicken is essentially a "one-shot" nester with limited renesting ability, so the effect of these variables may be minimal.

These behavioral patterns emphasize that vegetation on sanctuaries should be maintained in an attractive condition for nesting so that optimum spacing of nests can be manifested.

6. Rabbit Management — K. P. Thomas

A total of 780 rabbits were harvested on the Forbes Area in 1968 and 726 in 1967. Of those killed in 1968, 617 were harvested by the 293 hunters who sought rabbits only; in 1967 a greater number of rabbit hunters (321) killed 593 rabbits. Rabbit hunters in 1967 and 1968 spent approximately the same amount of time in the field, 3.9 and 4.1 hours, respectively, and harvested 0.5 rabbit per hour in both 1967 and 1968. These data indicate that the rabbit populations of 1967 and 1968 were approximately the same on the Forbes Area.

In 1968, 187 rabbits were tagged on Zone I (sharecrop-burn) prior to the hunting season. Forty-seven of the tags were returned by hunters. The population in Zone I was estimated, using the Lincoln Index, to be $1{,}066 \pm 282$, or 4 rabbits per acre. The harvest of rabbits by all hunters on Zone I was 268, or 25 percent of the rabbits available. Because the percentage harvest of cottontails was only 25 percent, the kill may not adequately represent the abundance of rabbits available to the hunters during 1968.

G. B. Rose

During the fall trapping period on the 4-H Area at Allerton Park in 1968, lengths and weights of captured cottontail rabbits were recorded on the first date of capture in each month, and weight-length relationships were used to calculate condition indices, using the formula: $C.I. = \frac{W - 16}{L^3}$, where W is the weight in grams and L is the length in decimeters (Bailey, J. A. 1967. MWRL 10(7):3). The mean condition index for October (37 animals) was 5.67, for November (100 animals) was 5.58, and for December (44 animals) was 5.65. The differences between means for the 3 months were not statistically significant at the 95 percent level of significance, although Bailey had found highly significant ($P < 0.005$) differences among the months November through March.

Bailey (1967) reported that the mean condition index of 499 rabbits captured from May through November in 1964, 1965, and 1966 was 5.48. The October, November, and December averages in 1968 are all significantly greater than Bailey's average. However, since different individual workers may obtain different results when measuring the same rabbits, it is not possible to know if the rabbits were in better condition this fall than in 1964-66, or if the difference in averages only reflects different measurements by different workers.

Several rabbits trapped in fall, 1968, had been captured the previous winter or before. The mean condition index of the rabbits recaptured in October 1968 (6.14) was significantly greater ($\underline{P} < 0.025$) than that of animals newly captured that month (5.56). Similarly, in November 1968 the mean condition index of the recaptured rabbits (6.13) was highly significantly greater ($\underline{P} < 0.001$) than that of animals captured for the first time (5.52). No significant difference was detectable for December, probably because only 2 of the 44 animals captured in December had been captured before fall, 1968. The mean condition index of the two animals was 6.27, and of the remainder, 5.62.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | March, 1969 | Vol. 12, No. 3

1. Pheasant Populations and Land Use

S. L. Etter, R. E. Greenberg

Because of the unbalanced sex ratio of adult pheasants and the nearly even sex ratio of juvenile pheasants, the overall sex ratio of the population is dependent upon the relative numbers of juveniles and adults. In 1962, for example, the overall sex ratio of 1,670 pheasants captured during prehunt trapping (October 1-November 11) was 75 cocks per 100 hens. Sex ratios within age groups were 20 and 95 cocks per 100 hens for adults and juveniles, respectively. The overall sex ratio of 413 pheasants captured during posthunt trapping (January 1-February 28) was 18 cocks per 100 hens. Thus, the apparent reduction in the proportion of cocks as a result of hunting was 57 cocks per 100 hens, or 76 percent of the 75 cocks per 100 hens in the prehunt population.

However, the ratio of juvenile hens to adult hens in the posthunt sample (133 per 100) was only about half as great as that in the prehunt sample (278 per 100). By using the sex ratios of adult (20 cocks per 100 hens) and juvenile pheasants (95 cocks per 100 hens) from the prehunt sample, and a juvenile mortality rate based on hens, a theoretical sex ratio in the absence of hunting was calculated for the posthunt sample. This figure, 63 cocks per 100 hens, indicated a substantial reduction in the sex ratio as a result of differential survival rates of juvenile and adult birds. Consequently, hunting was responsible for reducing the sex ratio by only 45 cocks per 100 hens (63 - 18) rather than 57 cocks per 100 hens (75 - 18).

These data show that the usual practice of attributing sex ratio changes entirely to hunting results in overestimating the proportion of cocks that are shot. Our present interpretation of the above data is that (1) 71 percent (45/63) of the cocks available during the hunting season were harvested and (2) the cocks that were shot represented about 60 percent (45/75) of the cocks alive during the prehunt trapping period. Both of these figures are minimum estimates since no attempt was made to account for illegal hen-kill.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

The chemical defoliate, Ortho Paraquat, has been extensively evaluated in both greenhouse and field tests in the United States and other countries. This chemical has proved useful as a contact killer of some broadleaf weeds and grasses and as a crop desiccant. However, it was the utilization of the chemical in pasture renovation that led to its use as an intergral part of minimum tillage operations in seeding grasses and legumes on roadsides for nesting pheasants.

In the early 1950's, agronomists learned that turning the soil prior to seeding a crop was not essential to good growth of the crop. When existing ground

cover was killed by chemicals and then seeded, excellent crop growth in the dead sod ensued. It was also possible to establish desirable species of grasses and legumes in old pasture sod after using herbicides to kill or inhibit the growth of the existing species. The marketing of Paraquat facilitated this process.

Several qualities of Paraquat make it a good agent for use in establishing desired grasses and legumes in roadside sod: (1) The chemical is rapidly absorbed by the sprayed plant. This rapid uptake by the foliage minimizes the effect of rainfall soon after application. (2) At recommended rates, the chemical leaves no harmful residual activity in the soil. Seeding can be done at the same time or immediately after spraying. (3) Paraquat exhibits very rapid action on the aerial parts of plants. (4) The chemical reduces competition from existing vegetation for several weeks after application. Tillage methods that disturb only a minimum portion of the seedbed can be employed for seeding grasses and legumes into existing sod. (5) Three years of working experimentally with Paraquat demonstrated that drift problems were minimal under a fairly wide range of wind conditions.

A 250-gallon sprayer towed behind a small tractor, driven in the ditch, was used to apply Paraquat to nearly 63 miles of roadsides throughout the Ford County Management Unit just prior to seeding during August and September, 1968. Spraying was carried out over a 7-day period, at times under wind conditions marginal for safe spraying, when most other agricultural chemicals could not have been safely utilized. There were only two places over the 63 miles where the chemical had any noticeable effect on adjacent crops. In both instances damage was slight.

This experience suggests that, with reasonable caution, Paraquat can be effectively and safely applied over substantial acreages of roadsides in a reasonably efficient manner.

3. Factors Influencing Distribution and Abundance of Pheasants

W. L. Anderson,
D. R. Vance

It was reported in a previous research letter (MWRL 12(1):2) that means of total concentrations of the major elements potassium and sodium were less, and those of seven trace elements were more, in grit from Neoga (poor pheasant range) than in grit from Sibley (good range). These differences were statistically significant. Means of total concentrations of the other three major elements (calcium, magnesium, and phosphorus) did not differ significantly, Neoga grit compared with Sibley grit. Since the writing of that report, the samples of grit have been reanalyzed to determine the amounts of potassium, sodium, calcium, magnesium, and phosphorus that are biologically available to pheasants. These analyses were performed by exposing the samples to conditions that simulated the environment in the gizzard, i.e., the samples were placed in a solution of HCl maintained at pH 2.1 and temperature 42 C, and gently agitated (145 rpm) on a mechanical shaker for 3 hours. Minerals that went into solution were considered to be available for physiological functions.

It was found that mean concentrations of biologically available sodium, magnesium, and calcium were less in grit from Neoga than in grit from Sibley. These area-to-area differences were not statistically significant, though the differences exhibited by sodium and calcium approached significance ($P < 0.10$). However, the percentages of the total calcium that were biologically available were considerably

less, on the average, in grit from Neoga (36.2) than in grit from Sibley (78.2); the difference was highly significant ($P < 0.01$). These findings add substantially to accumulating evidence that calcium might be influencing the distribution and abundance of pheasants in Illinois.

4. Responses of Bobwhites to Habitat Manipulation — J. Ellis, P. Matthews

Levels of prehunt populations of quail on the Forbes Area have been correlated with the median dates of hatch ($P < 0.05$). The later the median dates of hatch the higher the resulting fall populations. These data were obtained from 610 wings collected during the 1964-68 hunting seasons and aged by molt criteria. Thus, quail hatched late in the nesting season contribute significantly to fall populations. Increased survival of late-hatched quail is probably the explanation for this phenomenon. Data from the Dale Area indicated a similar--but not statistically significant--correlation.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

As reported earlier (MWRL 11(12):3), the distance between a booming ground and the preferred zone for nesting appears to be about 240 yards. A correlation ($r = -0.874$, $P < 0.01$) in support of this finding is that declining populations of prairie chickens at Bogota (1963-64) were associated with mean booming ground-to-nest distances greater than 500 yards; relatively stable populations (1965-66-67) were associated with mean distances of approximately 400 yards; and a population increase (1968) was associated with a mean distance of 293 yards. Although inadequate nesting habitat and spring plowing were important decimating factors acting on the population in preceding years, the above correlation indicates that increased advantages in reproduction were possible as annual mean distances from booming grounds to nests approached the preferred zone for nesting.

6. Rabbit Management — K. P. Thomas

Trapping effort on the sharecrop-burn zone of the Forbes Area during the period February 5-28, 1969, produced 132 captures of cottontails: 54 original captures, 34 captures of rabbits tagged during the fall of 1968, 3 mortalities, and 41 recaptures.

Sex differentials among the captures were: original captures, 29 males, 25 females; recaptures (from the 54 original captures), 7 males, 15 females; captures of rabbits tagged during the prehunt period, 7 males, 27 females. Females comprised 55 percent of the rabbits tagged during the prehunt period, but this difference was insufficient to account for the 7:27 ratio among recaptures. These data indicate that males were less prone than females to be recaptured even several months after their original capture, that males had a higher mortality rate than females, or that males had a higher rate of emigration than females.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois April, 1969 Vol. 12, No. 4

1. Pheasant Populations and Land Use — S. L. Etter, R. E. Greenberg

During the period April 17-29, 1968, all passable roads on the Sibley Study Area were driven a total of eight times in order to observe pheasants. Each observation period began at sunrise and continued until the entire area (80 miles) had been covered. Starting points were staggered so that no one portion of the study area was consistently covered earlier than other portions.

For the above April period, 1,223 observations (480 cocks, 743 hens) were recorded during the 5 hours following sunrise. The sex ratio of pheasants observed during the first 2 hours after sunrise was 60 cocks per 100 hens; the sex ratio for pheasants observed during the ensuing 3 hours was 108 cocks per 100 hens. A similar increase in the proportion of cocks among pheasants observed during the period from 2 to 5 hours after sunrise was also noted in 1967 (MWRL 11(4):1). In addition to changes in observed sex ratios, the total numbers of pheasants observed declined drastically after the first 2 hours after sunrise. Only 373 (31 percent) of the 1,223 observations were recorded later than 2 hours after sunrise.

As a consequence of these findings, roadside observations of pheasants to obtain indices of breeding populations in 1969 and future years will cover only one-half of the roads (40 miles) on the study area during each early-morning observation period.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

Since 1963, vegetation on seeded and on managed control roadside plots has been studied to determine changes in plant-species composition (frequency of occurrence) and the percentages of top cover contributed by various species (MWRL 11(6):1-2). The contribution of bromegrass (*Bromus* spp.) to total top cover was low the first year after seeding (20 percent) but increased substantially each year thereafter and accounted for 77 percent of the top cover on plots 6 years of age. At the same time, alfalfa (*Medicago sativa*) accounted for over 31 percent of the top cover on 1-year-old plots but decreased to only 13 percent on 6-year-old plots. Red clover (*Trifolium pratense*) contributed significantly to total top cover only the first year after seeding (14.8 percent); by the second year this species made up only 1.6 percent of the total top cover and less than 1 percent each year thereafter. Timothy (*Phleum pratense*) accounted for about 15 percent of the top cover on 1-year-old plots, nearly 23 percent the second year, but decreased to 5 percent by the sixth year. Grass weeds and broadleaf weeds made only insignificant contributions to total top cover in plots in all age classifications (less than 10 percent).

The dominance of brome on the plots can be expected to increase as the plots continue to age. Thus, while the frequency of occurrence of alfalfa on the plots has remained relatively high (occurring in 54 percent of the quadrats taken on 6-year-old

plots), alfalfa, and all other seeded and unseeded species except brome, accounted for only a little more than 20 percent of the top cover on plots 6 years of age. As the vegetation on plots becomes increasingly monotypic with increased age of the plots, it may be possible to assess the influence of these vegetative changes on pheasant nest densities.

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson, D. R. Vance

Recent investigations have revealed that several chemical elements are more, or less, abundant in grit from Neoga (poor pheasant range) than in grit from Sibley (good range). But does the chemical--and perhaps physical--makeup of grit from these areas affect pheasants differently? To partially answer this question, 12 juvenile hen pheasants were caged individually and fed grit from Neoga or Sibley (in amounts approximating rates of consumption) and corn (ad libitum) for 14 weeks beginning October 23, 1968. Six hens each were given grit from the respective areas. Amounts of grit consumed, amounts of corn consumed, and body weights of the hens were determined at 2-week intervals. At the end of the experiment, the hens were sacrificed and dissected to determine weights of sternal muscles, fat deposits, and internal organs.

Only seven hens (four fed Neoga grit and three fed Sibley grit) survived the experiment. Four died, apparently because they did not take grit or corn, or both, and one died from injuries sustained while thrashing about in her cage. The only discernible difference between the surviving hens fed Neoga grit and those fed Sibley grit was in the amount of grit consumed. The four hens fed Neoga grit consumed, respectively, 58, 63, 66, and 72 grams, whereas the three hens fed Sibley grit consumed 42, 44, and 45 grams. Although the data are meager, this finding indicates that (1) Neoga grit is more palatable than Sibley grit, or (2) the hens fed Neoga grit had to consume more grit to fulfill their minimal mineral requirements than the hens fed Sibley grit. We believe the latter interpretation is the more logical.

4. Responses of Bobwhites to Habitat Manipulation — J. Ellis, P. Matthews

During the hunting seasons (1963-68, 2,949 quail wings (1,677 from Forbes and 1,272 from Dale) were collected and aged. Sample sizes from Forbes ranged from 99 to 545 birds, with age ratios varying from 4.1 to 7.1 juveniles per adult. Sample sizes on Dale ranged from 110 to 347 birds and age ratios from 4.8 to 8.2 juveniles per adult. These ranges in age ratios did not deviate significantly from the mean on either area for the 6-year period. No correlation existed between population trends and age ratios on either area. Significant correlations were demonstrated, for both areas, and for the combined data, between (1) total adults and total juveniles, (2) between total adult males and total juveniles, and (3) between total adult females and total juveniles in the kill. These data indicate: (1) The number of juveniles in the fall population each year was dependent upon the size of the breeding population. Changes in fall population levels between years were due to changes in the numbers of breeding adults and not in the numbers of young produced per adult. (2) The sex ratios among the adults in the fall did not change significantly between years, and factors determining the breeding populations between years affected both sexes equally. It appears, therefore, that the quantity and quality of quail habitat--and not the sex and age structures of the populations--determined the fall population levels.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

In contrast to the peak count of 37 cocks at Bogota during the spring of 1968, weekly counts this spring indicate a flock containing at least 51 cocks--a 38 percent increase. A population of this size must still be considered as critically endangered, but this increase provides encouragement that the preservation of Illinois prairie chickens can ultimately be realized.

Donations have made possible the acquisition of 1,007.3 acres for sanctuaries since 1962. The Prairie Grouse Committee of the Illinois Chapter - The Nature Conservancy has acquired 390.3 acres at Bogota in Jasper County and 320 acres near Kinmundy and Forbes State Park in Marion County; the Prairie Chicken Foundation of Illinois controls 297 acres, all at Bogota. Current negotiations by a private conservationist should soon add a 100-acre farm near Farina to the sanctuary system in Marion County. In addition, the Illinois Department of Conservation is leasing 88 acres of grass and legumes as a holding action until an adequate refuge system can be established in Marion County near Farina and in southwest Effingham County near Loogootee. Including sanctuaries, leased acreage, and a 33-acre tract on Forbes Park, the total land managed for prairie chickens in Illinois now includes or will soon include 1,228.3 acres.

Censuses not yet completed in the Forbes Park, Kinmundy, Farina, La Clede, and Loogootee areas seem to indicate that the flocks in these areas are holding their own and that there is still time to insure their preservation.

6. Rabbit Management — G. B. Rose

Energy consumption, energy assimilation, assimilation efficiency, and weight changes of caged cottontail rabbits on a diet of commercial rabbit chow or one of two winter foods, *Rubus* sp. and *Rhus glabra*, were measured and compared.

The average energy consumed per rabbit per day was 238, 49, and 57 cal/day, respectively, for rabbit chow, *Rhus*, and *Rubus*. Similarly, the average energy assimilated was 162, 18, and 10 cal/day. The average assimilation efficiencies were 68, 32, and 19 percent, respectively. The rabbits on rabbit chow maintained their weight, while those on *Rhus* lost an average of 0.02 kg/day and those on *Rubus* lost an average of 0.04 kg/day. All the rabbits on rabbit chow survived, while three of four rabbits on *Rubus* died within 10 days, and one of three on *Rhus* died within 10 days.

Thus, rabbits forced to subsist entirely on *Rhus* or *Rubus*, or perhaps on the bark of other woody plants, as during winter when the ground is covered with snow, will not be able to maintain their weights, and some will die. Indeed, weight loss and death may come more quickly in the field during winter because of possibly greater energy requirements at low temperatures.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois May, 1969 Vol. 12, No. 5

1. Pheasant Populations and Land Use S. L. Etter, R. E. Greenberg

Roadside counts of pheasants on the Sibley Study Area on eight mornings during the period April 15-30 in 1968 and in 1969 recorded 18 percent fewer cocks in 1969 than in 1968. Index figures of 153 and 127 cocks were obtained from roadside observations in 1968 and 1969, respectively. The smaller number of cocks present in 1969 apparently resulted from a higher proportionate harvest of cocks during the hunting season of 1968 than during the hunting season of 1967. Winter sex ratios in 1968 and 1969 were 45 and 37 cocks per 100 hens, respectively. By using these figures, indices of 340 and 338 hens were calculated for 1968 and 1969, respectively. These data indicate that the number of breeding hens this year is essentially the same as that in 1968.

On the assumption that the above index figures show the same relationship to spring hen densities that was exhibited by hen indices and aerial censuses conducted in 1963 and 1965, the indices for 1968 and 1969 represent breeding populations of approximately 35 hens per square mile.

2. Manipulation of Pheasant Habitat G. B. Joselyn

On May 20, personnel of the Department of Conservation and the Natural History Survey inspected several of the roadsides on the Ford County Management Unit that were seeded last summer to brome and alfalfa for pheasant nesting cover. Apparently, the lack of adequate rainfall between the time of seeding and the end of the growing season has substantially retarded the development of the seedings (MWRL 12(2):1-2). It appears, however, that on many roadsides a considerable amount of germination has occurred this spring, which indicates that good stands of the seeded species may be expected by the end of this growing season. This should be the case on a greater proportion of the roadsides than had been anticipated. Reseeding, where needed, will be undertaken in August.

Because weeds will probably cause some problems this first summer of the seedings, it will be suggested in a letter to cooperating farm operators that they mow their roadsides whenever they consider them to be unsightly. Mowing will not harm the seedings and may even reduce weed competition with the seedings. It is hoped that by next summer the seedings will have attained an acceptable appearance and will be sufficiently free of weeds to preclude the need for mowing.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson, D. R. Vance

A total of 53 calling cock pheasants were located on the Neoga release area by audiocensuses during early May 1969. This count of breeding cocks was about the same

as the number counted in 1968 (57 cocks), but was 20 to 230 percent greater than the numbers counted annually during the period 1964 through 1967. The low count (16 cocks) was made in 1964, the year after pheasants were last released on the area. It is encouraging to note that the pheasant population at Neoga, though remaining at a low level of abundance, has increased markedly during the past 5 years.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, P. J. Matthews

Because quail and rabbit seasons run concurrently on the Dale and Forbes areas, hunters were classified as either quail hunters or rabbit hunters, or both. During the season of 1968, 559 quail were harvested on the Forbes Area. Of these, 173 (31 percent) were taken by rabbit--quail hunters. On the Dale Area, 348 quail were harvested in 1968. Quail hunters shot 86 percent (298) of the total kill.

Harvest data for quail hunters (only) demonstrated significant correlations ($\underline{P}<0.01$), for the Forbes and Dale areas, between total kill and percent total gun-hours throughout the season. Because the effect of hunting pressure (gun-hours) was not reflected in a reduced kill rate as the season progressed, it is apparent that the quail populations on both areas could have sustained a longer hunting season.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

During the period of late March to mid-April, 1969, 15 areas in nine counties in south-central Illinois were systematically cruised in search of booming prairie chickens, and an effort was made to determine the maximum number of cocks on each area. Censuses were discontinued on five areas where no prairie chickens, or only one cock, had been found in the spring of 1968.

This spring, a total of 140 prairie chicken cocks were counted on 10 of the 15 areas censused, an overall decrease of 6 percent since the spring of 1968. However, by excluding the Bogota Area, on which a 38 percent increase occurred between 1968 and 1969, the decline amounts to 21 percent. A similar statewide loss (19 percent) occurred between 1967 and 1968. No chickens were found on three of the areas censused in 1969, bringing the total of defunct census areas to 10 since 1963.

Thus, if a 50:50 sex ratio is assumed, the statewide population numbered about 280 prairie chickens in the spring of 1969. The Bogota flock presently accounts for 36 percent of the statewide population. Four other flocks in Effingham, Fayette, and Marion counties, which are distributed roughly 10 miles both north and south of Farina, comprise 50 percent of Illinois' remaining prairie chickens.

6. Rabbit Management — K. P. Thomas

During February 1969, 27 acres of brush and open cropland were burned on Zone I on the Forbes Area. This acreage included nine plots ranging in size from 1 to 7 acres.

Firebreaks on the area were established by mowing, then disking, during the fall of 1968. Costs of establishing these firebreaks included $40 for 6 hours of mowing and $40 for disking. To insure the safety of the operation, five personnel of the

Illinois Natural History Survey and the Division of Parks and Memorials performed the actual burning in 4 hours at an estimated cost of $60. The total cost of preparing the firebreaks and burning the plots was $140 or $5.19 per treated acre.

Nine plots totaling 70 acres were burned on the Dale Area in March 1969. Estimated costs of establishing firebreaks were $40 for mowing and $75 for disking. Burning of the plots was completed in 6 hours (24 man-hours) and cost approximately $70. Total costs for firebreaks and burning on the Dale Area were $185 or $2.64 per treated acre.

Costs of the burning operation on the Forbes Area were approximately twice as high as those for the Dale Area. The reported costs emphasize the economic advantage of treating comparatively large acreages in a management program of prescribed burning.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | June, 1969 | Vol. 12, No. 6

1. Pheasant Populations and Land Use

S. L. Etter, R. E. Greenberg

During the nesting seasons of 1962-68, 53 tagged hen pheasants were observed with their broods on the Sibley Study Area. Thirty of these hens were in their first nesting season; 23 were in their second or later nesting seasons. The ages of their broods were estimated to the nearest week on the basis of size and of plumage characteristics, and the approximate dates of hatch were obtained for each hen by backdating from the date of observation.

The earliest date of hatch for both first-season and older hens was the week of May 28-June 3. The latest dates of hatch for first-year and older hens were the weeks of July 30-August 5 and August 20-26, respectively. Twenty (67 percent) of the 30 first-year nesting hens hatched their clutches between June 11 and July 1; only 1 (3.3 percent) hatched a clutch after July 15. Of the 23 older hens, 9 (39 percent) hatched their clutches between June 11 and July 1, and 7 (30 percent) hatched their clutches after July 15.

Although the sample sizes involved are small, these data suggest that the nesting effort of older hens is more prolonged than that of hens in their first nesting season. Apparently, only a few hens in their first nesting season initiate nests after the latter part of June, whereas older hens apparently continue renesting until late July or early August. If this is the case, then first-year nesting hens may contribute little to production in years when nesting conditions are unfavorable during the first half of the nesting season.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

Until recent years, control of broadleaf weeds in grass-legume mixtures was difficult, as the most widely used chemical for controlling such weeds--2,4-D--could not be applied because of the damage that would be done to alfalfa (*Medicago sativa*) and red clover (*Trifolium pratense*). With the testing and marketing of 4-(2,4-DB), at least a measure of broadleaf weed control can be obtained in grass-legume mixtures without damaging the legumes. Because this chemical is a weak amine, it must be applied in early spring when broadleaf weeds are actively growing, and are 1 inch to 3 inches high. Spraying of larger weeds generally gives unsatisfactory results.

On May 1, 4-(2,4-DB) was applied at a rate of 6 pints per acre to the 6 miles of seedings that were planted in April 1968 along highway 47 in Ford and Livingston counties. In this instance, the control of broadleaf weeds was satisfactory. Between May 5 and May 8, the chemical was used on all roadsides on the Ford County

Management Unit that were seeded during August and September, 1968. The degree of control achieved throughout this area was somewhat less than had been hoped for. Some weeds were eliminated, but control of species such as curled dock (Rumex crispus) was not satisfactory. Nevertheless, 4-(2,4-DB) appears to be of some value in the control of broadleaf weeds on seeded roadsides provided application is made at the proper time.

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson, D. R. Vance

Twenty-five hen pheasants were collected in Ford and Livingston counties during May 1969 and were dissected to obtain information on the physical condition and reproductive performance of actively laying hens in Illinois' better range. The body weights of these birds averaged 1,052 grams, which is slightly less than the mean weight (1,066 grams) of laying hens collected from 1966 through 1969. Mean weights of selected body parts excised from the hens collected in 1969, compared with those from hens collected during the 3 preceding years, were: sternal muscles, 97 percent; fat strip, 85 percent; visceral fat, 93 percent; liver, 101 percent; and ovary, 104 percent. Because the mean weights of sternal muscles from hens collected in preceding years were remarkably consistent (242.4, 240.4, and 241.4 grams in 1966, 1967, and 1968, respectively), the decreased weight of sternal muscles from hens collected in 1969 is noteworthy. These findings suggest that hens in the state's better pheasant range entered the nesting season in poorer physical condition in 1969 than did the "average" hen in the 3 preceding years.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, P. J. Matthews

Results of the prebreeding censuses of quail conducted on the Forbes and Dale areas during early March 1969 revealed the highest prebreeding populations ever recorded on the areas. On Dale, 13 coveys totaling 140 quail (12.7 per 100 acres) were located. The prebreeding population in 1969 on Dale exceeded that of 1968 by 35 percent. Seventeen coveys containing 171 quail (7.3 per 100 acres) were located on the Forbes Area in March 1969, an increase over the prebreeding population in 1968 of 52 percent.

The size of the prebreeding populations has been statistically correlated ($P<0.05$) with the size of the subsequent prehunt populations. We can predict, therefore, that the prehunt quail populations on Dale and Forbes in 1969 will equal or possibly exceed the prehunt populations of 1968.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

It is imperative that provisions be made for the establishment of booming grounds on prairie chicken sanctuaries because courtship grounds are important focal points of prairie chicken ecology. Among the better-known requirements for a well-established booming ground are (1) good visibility at ground level, and wide horizons; (2) short cover, as on soybean stubble, green winter wheat, or bare plowed ground; and (3) proximity to nest-brood habitat and perhaps to roosting habitat.

A requirement not well defined is the size that a field must be to become the site of a booming ground. During the past seven springs at Bogota, the fields used

for 33 well-established booming grounds have averaged 21.7 acres in size and have ranged from 10 to 40 acres or more, depending on how field boundaries were determined. (The inclusion of adjacent fields that are as open as the field actually containing the booming ground increases the upper range.) Well-defined booming grounds were established on the 77-acre Yeatter Sanctuary during three springs when 10- to 12- acre fields were plowed. A booming ground also became established in the center of the 140-acre Zimmerman tract on a 10-acre burn made February 28, 1968. In 1969, only booming grounds of uncertain status (few cocks, irregularly present) occurred on the Yeatter and Zimmerman tracts, possibly because available booming sites were only 5-6 acres in size. These responses, plus the fact that no nests have been found at Bogota closer than 117 yards from an estimated center of a booming ground, provide strong evidence that fields suitable for booming should be approximately 10 acres in size. Fields larger than 20 acres are not desirable because the preferred zone for nesting apparently begins about 200 yards from a booming ground, and it is advantageous to the population for hens to nest within 200-500 yards of a booming ground (MWRL 12(3):3). It also appears desirable that suitable booming sites be available by mid-September each year. All known booming grounds that were established in autumn at Bogota carried over into the following spring and became stable grounds.

6. Rabbit Management G. B. Rose

Estimated assimilation efficiencies (percentages of digestible energy in the diet) of growing young rabbits decreased with age. The younger rabbits (3-5 weeks) had assimilation efficiencies of 93 to 96 percent (averaging 94 percent); older rabbits (7-9 weeks) had assimilation efficiencies of 77 to 88 percent (averaging 82 percent). The decreasing assimilation efficiencies probably reflect a change of diet, for, although the rabbits were fed the same diet of evaporated milk, rolled oats, and Purina rabbit chow, the percentage of rabbit chow eaten increased with age.

Although the total amount of energy assimilated per animal per day increased with body weight (from 69 kcal/animal/day at a body weight of 186 grams to about 95 kcal/animal/day at a body weight of 575 grams), it increased more slowly than did body weight, so that the amount of energy assimilated per gram body weight per day decreased (from 0.37 kcal/g/day at a body weight of 186 grams to 0.17 kcal/g/day at a body weight of 575 grams).

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois July, 1969 Vol. 12, No. 7

1. Pheasant Populations and Land Use S. L. Etter, R. E. Greenberg

During the summer of 1968, several hen pheasants were captured and equipped with miniature radio transmitters. Only one of these hens brought off her brood successfully. She was tracked for 12 weeks to make a pilot study of brood movements, using radiotelemetry.

The hen was netted on July 8 while she was incubating a clutch of 10 eggs on an unmowed roadside. Nine of the eggs hatched on July 11 and the hen moved her brood about 150 yards south into a cornfield. Her location was monitored several times daily during July and August, and more frequently during September. There was little day-to-day movement during the 12-week tracking period. The hen was never found more than 0.5 mile from her nest. Her daily movements rarely exceeded 0.25 mile and were often less than 220 yards, especially if she was near a field edge.

2. Manipulation of Pheasant Habitat G. B. Joselyn

On July 10, the 62.8 miles of roadside on the Ford County Management Unit that were seeded to a brome-alfalfa mixture last summer were checked to determine the success of the seedings. Stops were made at least once within each quarter mile of roadside where seedings had been made. The amount of brome and alfalfa present on the roadside at each stop was placed in one of three categories: (1) fair to good, (2) questionable, (3) poor to unacceptable.

Of the 62.8 miles checked, 53.8 (86 percent) were tentatively judged to contain sufficiently good stands of brome/alfalfa to preclude reseeding. (Nearly 36 miles of roadside, 57 percent, were judged to have "fair to good" alfalfa growth, constituting greater success with the legume than had been indicated by spot checks early last spring.)

Success of the seedings on approximately 2.5 miles (4 percent) of roadside was considered questionable at this time, and 6.5 miles (about 10 percent) were judged to need reseeding. Two of the 6.5 miles were graded as part of a road maintenance project after the seedings were made, and will be reseeded this August.

It should be stressed that the criteria used to categorize the status of the seedings at this time may prove to be in error. An accurate assessment

of the overall success cannot be made until next summer. However, the relatively high proportion of roadsides with what are judged to be adequate stands of alfalfa provide hope that the overall success of the seedings will be greater than was at first anticipated.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson, D. R. Vance

Grit from Sibley (good pheasant range) and Neoga (poor pheasant range) was fed to juvenile hen pheasants to determine what effects, if any, the two types of grit might have on pheasants (MWRL 12(4):2). Excessive mortality of the birds did not allow the original objective to be fully met. However, samples of the grit fed to the pheasants and grit from the gizzards of birds surviving to the conclusion of the study were analyzed spectrographically for 28 chemical elements and for biologically available Ca, K, Mg, Na, and P (MWRL 12(3):2). This analysis provided some indication of the changes in mineral composition of grit after it was consumed by pheasants.

Of the 28 elements, 10 (Ca, Mg, B, Ba, Fe, Ga, Mn, Sr, Ti, Y) in Sibley grit were less than half as concentrated in grit from gizzards of the birds as in the original sample; 16 elements (Ca, Mg, Na, Al, B, Ba, Co, Fe, Mn, Pb, Sr, Ti, V, Y, Yb, Zr) in Neoga grit were less than half as concentrated in grit from gizzards as in the grit fed to the pheasants. The analysis for biologically available major elements showed similar results. Biologically available Ca and Mg were lower in concentration in gizzard grit than in the original grit sample for Sibley, but the concentration of Na was about 5 times higher in gizzard grit. Neoga grit showed consistently lower concentrations for all five major elements in gizzard grit than in the original sample. These findings indicate that elements are selectively removed from grit in the gizzards of pheasants; such selection presumably aids in maintaining the physiological mineral balance in the birds.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis, P. J. Matthews

Crops from quail harvested on the Forbes Area in 1967 were separated according to the management zone in which they were shot. Food items in the crops were identified and listed by frequency of occurrence. The five most frequently occurring foods are presented for each of the three management zones; one or more of the five foods were found in approximately 95 percent of the crops from the zone for which they are listed.

The five most frequently found seeds in crops from birds harvested on Zone I were soybean (*Glycine max*), common ragweed (*Ambrosia artemisiifolia*), Korean lespedeza (*Lespedeza stipulacea*), corn (*Zea mays*), and foxtail (*Setaria* spp.). This zone was managed by sharecropping and limited burning. Soybeans occupied 35 percent of the land area in Zone I in 1967. In crops from Zone II, which was managed by the food-patch system, the five most frequently occurring foods were Korean lespedeza, wild bean (*Strophostyles* spp.), common ragweed, tick-clover (*Desmodium* spp.), and buckwheat (*Fagopyrum esculentum*).

Buckwheat was included in the food patches established on this zone. Korean lespedeza, tick-clover, wild bean, common ragweed, and oak (Quercus spp.) were the five most frequently occurring seeds in the crops from Zone III. This zone was also managed by the food-patch system but less intensively than Zone II.

Although the bobwhite feeds on a wide variety of plant seeds, the bulk of its diet is supplied by seeds of plants associated with the early stages of secondary succession and by seeds of agricultural crops. Availability is probably the important factor in determining the food items selected. Management should create and maintain early stages of secondary succession primarily to provide sources of food.

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier

Estimates of the number of hens in a population of prairie chickens are not easily attained because, unlike the cocks, hens are not regularly present on booming grounds in spring. However, observations of hens made during weekly (often at more frequent intervals) booming ground surveys at Bogota do provide some basis for estimating sex ratios and making comparisons for the years 1963-69. The count of 47 individual hens, observed on and off booming grounds during one morning in 1969, was 114 percent higher than the previous high count of 22 hens, made in the spring of 1966. The high count of cocks in 1969 was 51. Thus, these observations suggest the existence of a nearly balanced sex ratio among prairie chickens at Bogota at the onset of the breeding season in 1969.

6. Rabbit Management K. P. Thomas

A study of the vegetation on three plots was initiated in 1969 on the sharecrop-burn zone of the Forbes Area to determine the effects of the prescribed burning program on intermediate stages of succession. Each plot was characterized by goldenrod (Solidago spp.) and the invasion of persimmon (Diospyros virginiana) and sassafras (Sassafras albidum). One of the plots had not been burned since 1963, the second was burned initially in 1969, and the third area was burned in 1967 and 1969. In the 20 quadrats taken on each plot, 24 plant species were found on the unburned plot and 24 were noted on the area that had received two burns. Twenty-nine species of plants were recorded in the remaining plot. Eight species, common to the three plots, represented approximately 50 percent of the vegetative cover on each plot. Twenty-four species were common to at least two areas.

Despite the similarity in the total vegetative aspect and in the number and kinds of species on the areas, a basic difference was noted in the dispersion of plants on the burned plots and the unburned plot. An average of four species per quadrat were found on the unburned plot, whereas an average of six species per quadrat were recorded on the burned plots. The integration of species becomes more apparent when the numbers of species in the first 10 quadrats taken on each plot are compared. Twenty-two species were represented on the first 10 quadrats taken on the area burned twice and 25 species on the first 10 quadrats taken on the area burned only in 1969; only 10 species had appeared by the 10th quadrat on the unburned area. The greater integration of vegetation afforded by the burned plots may be effective in regulating the spacing pattern of animals that are dependent on the plant community.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | August, 1969 | Vol. 12, No. 8

1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

Occasionally, one or more pheasant eggs disappear from pheasant nests, with no trace of eggshell fragments or other evidence to indicate the cause of nest destruction. On rare occasions entire clutches of as many as 9 or 10 eggs have disappeared between nest visits. In the past this loss of eggs has been attributed to ground squirrel predation or human interference. A recent observation, however, indicates that egg losses under these circumstances may result from predation by snakes.

On July 22, 1969, while visiting previously found nests in an unmowed hayfield to determine their fate, a fox snake (Elaphe vulpina) was discovered in a pheasant nest containing a clutch of 4 eggs. At the time of discovery the snake had swallowed one egg, which was located approximately 1 inch posterior to the back of the snake's head. After its capture, the snake regurgitated the intact egg. Apparently, the snake had only recently eaten the initial egg and perhaps would have remained in the nest until the additional 3 eggs could have been consumed.

While this observation may account for the disappearance of entire eggs from pheasant nests, the significance of snake predation as an agent of nest destruction is unknown. No hen was present when the nest was initially found, nor did examination of the eggs reveal any evidence of incubation. Thus, it is impossible to determine whether a snake, even of this size (43 inches), could actually force an incubating hen to abandon her nest. It may well be that snakes prey only upon abandoned nests or upon unattended nests during the laying period.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

Densities of pheasant nests in 1969 on seeded roadside plots (1.6 nests per acre represent the lowest rate of nest establishment on this type of roadside during any of the past 7 years. The nest density on managed control roadside plots was 1.4 nest per acre this year. Rates of nest establishment on seeded roadsides have varied from a low (previous to this year) of 2.0 nests per acre in 1968 to a high of 3.8 nests per acre in 1964. On managed control plots, nest densities decreased each year from 1963 (2.8 nests per acre) to 1968 (1.4 nests per acre).

Over the 7-year period, 336 nests have been established on seeded plots (2.6 nests per acre), compared with 232 nests on managed control plots (1.8 nests per acre).

3. Factors Influencing Distribution and Abundance of Pheasants

W. L. Anderson,
D. R. Vance

William Wishart, Alberta Department of Lands and Forests, recently published a technique for identifying pheasants as juveniles or adults by measuring the shaft diameter and total length of the first primary feather (JOURNAL OF WILDLIFE MANAGEMENT

33(3):714-717). By plotting the measurements on a graph, Wishart was able to separate juveniles from adults by drawing diagonal lines through the point 3.02 mm and 157 mm for hens, and the point 3.30 mm and 170 mm for cocks. Adults had the larger feathers. The technique was 97 percent accurate for both sexes.

Because wings, as well as other body parts, from pheasants collected in Illinois during the past 3 years had been saved and kept frozen, it was possible to test the reliability of Wishart's technique for determining the age of pheasants in this state. Sixty-eight hens and 34 cocks collected during fall and winter were used; these pheasants were previously aged by probing the bursae and by examining the gonads. It was found that 66 (97 percent) of the hens and all 34 of the cocks could be correctly aged by measuring the first primary. However, the line of separation between juvenile hens and adult hens passed diagonally through the point 2.98 mm and 153 mm, which is slightly lower than the separation point Wishart gave for hens in Alberta. The separation point for determining the age of Illinois cocks did not differ appreciably from the point Wishart gave for cocks in Alberta. As this technique for determining the age of pheasants is reliable during spring and early summer--when the bursal-depth technique is not--it should open the doors to considerable new knowledge of pheasant biology.

4. <u>Responses of Bobwhites to Habitat Manipulation</u> J. A. Ellis, P. J. Matthews

The mean weight of 254 (21 percent) of 1,199 quail harvested on the Forbes Area from 1966 to 1968 was 180 ± 16 g. Mean weights of harvested quail varied, among years, from 174 g in 1967 to 184 g in 1968. Also, the mean weights of birds harvested on the experimental management zone (Zone I) were consistently lighter than those of quail harvested on the remainder of the park. The greatest discrepancy in mean weights of quail from Zone I, compared with the mean weights of quail from the remainder of the park, was 14 g in 1967. In 1968, however, this discrepancy was only 1 g.

No correlation was found between the prehunt population densities and the mean weights of harvested quail for the years 1966-68.

5. <u>Responses of Prairie Chickens to Habitat Manipulation</u> R. L. Westemeier

The increased population of prairie chickens present on the Bogota Study Area in 1969 probably resulted from successful nesting in 1968, made possible by (1) a substantial acreage of sanctuaries located in strategic areas and (2) relatively early spring plowing, which gave nesting hens few alternatives but to nest on the sanctuaries. Only two nests were reportedly destroyed by plowing in 1968. By contrast, 18 nests were destroyed by farming activities in 1964 and a subsequent decline of 35 percent was recorded for the Bogota flock in 1965. Fourteen (78 percent) of the 18 nests found on the sanctuaries during the summer of 1968 had successfully hatched. As of August 19, 1969, 22 prairie chicken nests had been found on sanctuaries at Bogota, of which 14 (64 percent) were hatched nests. Because of wet conditions in 1969, plowing was delayed until after the peak of hatch in several key fields of wheat stubble-legumes on private farmland. Correspondingly, no nests were reportedly destroyed by farming activities in 1969. Thus, with 2 consecutive years of relatively good nesting success, it is hoped that a second increase in the population level of the Bogota flock is in the making.

6. Rabbit Management

G. B. Rose

The energy consumed, energy assimilated, and assimilation efficiencies of growing young rabbits were measured and compared with those of adult rabbits. The young animals were kept in cages and fed a diet of evaporated milk, rolled oats, and commercial rabbit chow. The caged adults were fed only the rabbit chow.

Although the total amount of energy assimilated per animal per day increased with body weight (from about 30 kcal/animal/day for juvenile animals weighing between 100 and 125 grams, to 97 kcal/animal/day at a body weight of 570 grams, to between 100 and 175 kcal/animal/day for adult animals weighing between 1,000 and 1,200 grams) it increased more slowly than did body weight, so that the amount of energy assimilated per gram body weight per day decreased (from between 0.27 and 0.37 kcal/g/day for animals weighing between 100 and 200 grams, to 0.17 kcal/g/day at a body weight of 570 grams, to 0.15 and 0.09 for adult animals weighing between 1,000 and 1,200 grams).

Although animals were fed ad libitum on the mixed diet mentioned above, the amount of commercial rabbit chow eaten relative to the total energy consumed tended to increase as the animals grew older (from between 1 and 46 percent for animals weighing between 100 and 300 grams, to between 27 and 55 percent for animals weighing between 300 and 600 grams). The percentage of rabbit chow in the diet of an animal was inversely related to its assimilation efficiency. Thus, animals consuming less than 2 percent of their energy in the form of rabbit chow had assimilation efficiencies of greater than 99 percent. Assimilation efficiencies decreased with increasing percentages of rabbit chow consumed until those animals consuming between 50 and 60 percent rabbit chow had assimilation efficiencies of 77 to 82 percent, and animals fed only rabbit chow had assimilation efficiencies of 59 to 75 percent. Thus, the rabbits assimilated more than 99 percent of the energy of the evaporated milk and the rolled oats and an average of 68 percent of the energy of the rabbit chow. A mixed diet such as this, where the animals can choose different foods, is not adequate to determine whether the assimilation efficiencies of animals change with growth. It will be necessary to feed growing animals a diet consisting of a single item, i.e., rabbit chow, to determine differences in assimilation efficiency as the animals mature.

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Dr. George Sprugel

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois September, 1969 Vol. 12, No. 9

NATURAL HISTORY SURVEY
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1. Pheasant Populations and Land Use S. L. Etter, R. E. Greenberg

Standardized counts of pheasant broods, made on the Sibley Study Area during July and August 1969, revealed 19 percent more broods than in 1968. One hundred twenty-seven broods were observed along 640 miles of roadside transect (two 40-mile routes were driven weekly), compared with 107 broods in 1968. The average size of broods judged to be completely counted was 5.2 chicks, compared with 5.0 chicks in 1968, an increase of 4 percent.

The number of adult hen pheasants observed along these same 640 miles increased from 167 in 1968 to 230 in 1969 (38 percent). Forty-five percent of the adult hens observed in 1969 were broodless, compared with 35 percent in 1968.

The above indices, except the percentage of broodless hens, suggest an increase in production in 1969, compared with 1968.

2. Manipulation of Pheasant Habitat G. B. Joselyn

In the last Monthly Wildlife Research Letter (12(8):1) it was reported that densities of pheasant nests this year on seeded roadside plots (1.6 nests per acre) represented the lowest rate of nest establishment on this type of plot during any of the past 7 years (1963-69). The rate of establishment on managed control plots in 1969 (1.4 nests per acre) was the same as that of the preceding year, which was the lowest in 6 years.

On seeded plots in 1969, successful nest production (0.6 nest per acre) was the second lowest in the past 7 years, while production on managed control plots (also 0.6 nest per acre) was the highest in the 7 years. Production on seeded roadsides has varied from a low of 0.5 nest per acre in 1965 to a high of 1.1 successful nests per acre in 1963. On managed control plots, production has been fairly consistent, between 0.3 nest per acre in 1964 and 0.6 nest per acre this year. Over the 7 years, 99 nests have hatched on seeded plots (0.8 nest per acre), compared with 59 on managed control plots (0.4 nest per acre).

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson, D. R. Vance

The recent discovery that the age of pheasants can be determined by measuring the proximal primary (see MWRL 12(8):2) has made it possible to compare condition parameters of yearling adult (1 year old) hens to those of old adult (2 or more years old) hens during the nesting season. The findings of this report are based on data obtained from 107 hen pheasants collected during the prenesting periods (early

April), laying periods (May), and incubating periods (June) of 1967-69. The hens were dissected to determine the weights of selected muscle groups, fat deposits, and internal organs.

It was found that during all three periods--prenesting, laying, and incubating--the mean weights of the entire body, of sternal muscles, and of the fat strip of old adults were greater than those of yearling adults; the differences exhibited by all three parameters were statistically significant ($P < 0.05$) during the prenesting and laying periods. The mean weights of the entire body of yearling adults and of old adults were, respectively, 965±24 (14 hens) and 1,138±25 (16 hens) grams during the prenesting period, 1,038±13 (30 hens) and 1,112±14 (17 hens) grams during the laying period, and 854±18 (20 hens) and 879±22 (10 hens) grams during the incubating period. These findings indicate that during the nesting season old adult hens are in better physical condition--and presumably are better prepared for meeting the energy demands of reproduction--than are yearling adult hens.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, P. J. Matthews

We have used counts of whistling bobwhites along standardized routes on the Forbes and Dale areas for the period May 15-July 15 as indices of fall population densities (MWRL 10(9):2). The average number of calls rather than the average number of whistling cocks, per listening stop, has been the more reliable index of the fall populations on both areas, because the actual number of cocks at a particular stop has been difficult to determine when more than six were calling.

For 1969, the average number of calls per stop on Forbes (26.9) indicated that the fall population will be 34.4 quail per 100 acres, an increase of 5 percent over the estimate obtained by the same method in 1968. On Dale, the predicted prehunt population in 1969 will be 36.9 quail per 100 acres, compared with 33.4 quail per 100 acres in 1968, an increase of 10 percent.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

An initial attempt at restoration of some native prairie vegetation was made at Bogota on the Yeatter Sanctuary in the spring of 1963. Big bluestem (*Andropogon gerardi*), little bluestem (*A. scoparius*), Indian grass (*Sorghastrum nutans*) and switch grass (*Panicum virgatum*) seed was broadcast by hand on new (fall 1962) seedings of redtop (*Agrostis alba*). Subsequent management of these seedings was limited to combining for redtop seed and mowing for weed control. The presence of the prairie grasses was not readily apparent until the fall of 1967. By late summer, 1969, switch grass was well established and the other three species were present, to a lesser degree, on the Yeatter Sanctuary.

In March 1966, a 10-acre field of soybean (*Gycine max*) stubble on the 140-acre Zimmerman tract was disked and seeded using a mixture of big bluestem, Indian grass, and switch grass, plus timothy (*Phleum pratense*) as a companion crop and oats (*Avena sativa*) as a nurse crop. Seeds from all five species were mixed together, broadcast mechanically, and covered using a spike harrow. Subsequent management included the following: (1) combining the oats nurse crop (July 1966) and clipping for weed

control (August 1966); (2) burning one-half of the field in February 1968; (3) burning the remaining one-half of the field in August 1968. By the second fall (1967) after seeding, the presence of each prairie grass was readily apparent and by late summer, 1969, a luxuriant stand of the three prairie species resulted, particularly in the portion of the field that was burned in February 1968. These responses suggest that prairie grass can be established more rapidly using oats and timothy with the initial seeding, followed by late-winter burning, than by the method of establishment initiated in 1963.

Numerous approaches to prairie restoration have been implemented since 1966 on sanctuaries in Jasper and Marion counties. Prairie grasses established to date are mainly of Nebraska or Kansas origin. Additional seedings have been made using hand-stripped seed from various native composites, legumes, and other forbs as well as grasses from local railroad and roadside rights-of-way. Recently, arrangements have been made to harvest seed by combining along the Illinois Central Prairie near Kinmundy in an effort to obtain a large quantity of seed from as many native species as possible, all of local origin.

6. Rabbit Management

G. B. Rose

The energy of assimilation and the energy of growth (secondary productivity) of caged young rabbits in various stages of growth were measured and compared. The youngest animals were fed a diet of evaporated milk, rolled oats, and rabbit chow; the older animals were fed only rabbit chow.

Respiration energy was estimated by subtracting the growth energy from the assimilation energy. Respiration per animal per day increased with body weight (from an average of 23 kcal/day for animals weighing between 100 and 125 grams, to an average of 137 kcal/day for animals weighing between 800 and 1,000 grams). The respiration energy per gram body weight decreased as body weight increased (from an average of 0.21 kcal/g body wt for animals in the 100- to 125-gram weight range to an average of 0.14 kcal/g body wt in the 800- to 1,000-gram weight range).

The percentage of assimilated energy converted into growth (net growth-efficiency) decreased as body weight increased (from an average of 40 percent for animals in the 100- to 200-gram weight range to 12 percent for animals in the 800- to 1,000-gram weight range).

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

NATURAL HISTORY SURVEY
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Urbana, Illinois October, 1969 Vol. 12, No. 10

1. Pheasant Populations and Land Use — S. L. Etter, R. E. Greenberg

Incidental to the standardized counts of pheasant broods, made on the Sibley Study Area in July and August each year, the numbers of rabbits observed were also recorded. The numbers of rabbits observed along 640 miles of roadside transect (two 40-mile routes were driven weekly) were high in 1962 and 1963 (193 and 179, respectively), decreased drastically in 1964 and 1965 (103 and 33, respectively), and remained low during 1966, 1967, 1968, and 1969 (52, 45, 51, and 53, respectively). Thus, the trend in rabbit numbers on the Sibley Study Area has closely paralleled that of pheasant numbers.

These data indicate that the reduction in acreages of forage crops (hay and small grains) and the removal of fencerows and other brushy areas during the past 8 years have resulted in a reduced carrying capacity for rabbits as well as pheasants. Although data on the abundance of other resident birds and mammals have not been collected, it appears probable that the changes in agricultural practices, 1962-69, have drastically reduced the ability of the Sibley Study Area to support resident wildlife.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

It is desirable to compare pheasant nest establishment and success on seeded roadside plots with that occurring on "typical" unseeded roadsides on the study area. Because most farm operators usually mow roadsides several times each summer, managed control roadside plots (which remain unmowed until late summer) are not representative of other roadsides on the study area. Therefore, additional roadside segments on the study area were picked at random and searched for pheasant nests each summer from 1963 through 1969.

For the 7 years, pheasant nest density on seeded plots (2.6 nests per acre) was somewhat more than double the density of nests on all (mowed and unmowed) unmanaged control plots (1.2 nests per acre); seeded plots had between 1.0 and 2.1 more nests per acre during each of the 7 years. Nest density on seeded plots was more than triple that on unmanaged plots which were mowed (0.8 nest per acre), but only about one-fourth higher than the density on unmanaged control roadsides which were unmowed (2.0 nests per acre).

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson, D. R. Vance

It is well known that hen pheasants selectively consume limestone (calcium carbonate) grit during the laying period. Thus, determining the mineral makeup

of limestone grit from poor pheasant range, relative to that of limestone grit from good range, constitutes an important part of the continuing investigation of possible effects of chemical elements on the distribution of pheasants in Illinois. Samples of limestone grit, 2-6 mm in diameter, were collected from 10 sites each at Neoga (poor range) and at Sibley (good range), and spectrographically analyzed for calcium, magnesium, phosphorus, potassium, and sodium, plus 23 trace elements. Mean concentrations of three elements exhibited statistically significant ($P < 0.05$) differences, Neoga limestone compared with Sibley limestone. Nickel was more abundant, and sodium and lead were less abundant, in the limestone from Neoga than in the limestone from Sibley. When these differences are considered in light of current knowledge of mineral nutrition, only the difference exhibited by sodium appears to be of potential importance in limiting the distribution of pheasants. Sodium was also less abundant in unsorted grit (all grit 2-6 mm in diameter that occurred in samples of soil) and in pheasant livers from Neoga than in those from Sibley (MWRL 12 (1):2 and 12 (2):2).

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, P. J. Matthews

One of the problems in describing the vegetative conditions of an area is to determine what particular time of the growing season to make the analyses. Since 1966 we have measured vegetative conditions on the experimental management zones of Forbes and Dale by taking quadrat samples during August. The vegetation present in August prevails throughout the winter, and, by August, most of the plants are identifiable.

In 1969, quadrat samples of vegetation were taken in 1-year-old corn plots on the Forbes Area in May and August. Results of these vegetative analyses revealed that more plant species were found in May than in August. However, the most abundant species found in August--rough buttonweed (*Diodia teres*), common ragweed (*Ambrosia artemisiifolia*), smartweed (*Polygonum* spp.), and goldenrod (*Solidago* spp.)--were also the most abundant plants in May. Plants common in May but conspicuously absent in August were: water-starwort (*Callitriche terrestris*), bittercress (*Cardamine arenicola*), shepherd's purse (*Capsella bursa-pastoris*), and forget-me-not (*Myosotis virginica*). The amount of bare ground changed relatively little from May, 30 percent, to August, 35 percent.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

Prescribed burning has been accomplished on 47 plots totaling 279 acres on prairie chicken sanctuaries at Bogota; 41 acres were burned in March 1968, 61 acres in August 1968, 74 acres in March 1969, and 103 acres in August 1969. The objective of burning is to learn whether fire can be used to maintain the attractiveness of the sanctuaries for nesting hens. Thus far, searches for nests were made in the following types of cover: 51 acres (15 plots), the first growing season after a March burn (March burn I); 54 acres (11 plots), the first full growing season after an August burn (August burn I); and 21 acres (5 plots), the second growing season after a March burn (March burn II).

No nests have yet been found in the March burn I type; in 1969, one nest was found in the August burn I type (1.9 nests per 100 acres) and three nests were

found in the March burn II cover (14.3 nests per 100 acres). Most of the burning done so far was of light to moderate intensity whereby a patchwork of unburned residual vegetation was usually left on the ground. Seemingly, an ample amount of nest material was still present for the nesting season immediately following a March or August burn. However, the limited data tend to indicate that at least one growing season must pass before a burned field is acceptable for nesting.

In 1969, wet weather conditions may have been an important factor influencing nest site selection. Heavy layers of duff on the ground appeared to be more important to nesting hens in 1969 than in any of the preceding 6 years of this study. For example, in six fields for which valid comparisons could be made between numbers of nests in March burn I, August burn I, and unburned portions of the fields, all eight of the nests found in the six fields were in the unburned portions.

6. Rabbit Management G. B. Rose

The annual fall censusing of cottontail rabbits on the 100-acre (40-hectare) 4-H Area at Robert Allerton Park is being continued this fall, the 14th successive year. One hundred thirty-one rabbits were trapped and ear-tagged during a 10-day period at the beginning of October. Several population estimates were calculated from the capture and recapture data. The Schnabel (short form) estimate is 157 animals; the geometric maximum likelihood estimate (MLE-G) is 288; and the maximum likelihood estimate from a regression of the logarithm of the number of individuals in a frequency class on frequency of capture (MLE-R) is 279. The MLE-R is regarded as the best method of estimation. This estimate of 279 is much larger than the estimates of 177 and 211 for October and November 1968, and of 170 and 176 for October and November 1967; it is the largest estimate since the years 1956-61.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

NATURAL HISTORY SURVEY
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Urbana, Illinois | November, 1969 | Vol. 12, No. 11

1. Pheasant Populations and Land Use

S. L. Etter, R. E. Greenberg

Pheasant hunting on the Sibley Study Area during the opening weekend of the hunting season in 1969 was slightly better than it was in 1968. Hunters interviewed on the area this year reported spending an average of 4.3 hours in the field to bag a cock pheasant, compared with 5.0 hours in 1968. Comparable figures for 1962 through 1967 were 2.2, 2.7, 2.1, 8.0, 6.9, and 8.1 hours, respectively.

The increased hunting success this year, compared with 1968, apparently resulted from increased pheasant numbers (MWRL 12(9):1), since more unharvested corn was present on the study area this year than in 1968. Completion of the corn harvest is expected to result in even better hunting as the season progresses. Consequently, hunter success for the entire season in 1969 is expected to exceed that in 1968 by a greater margin than was indicated by the data obtained during the opening weekend.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

For the 7 years, 1963-69, pheasant nest density on seeded roadsides was more than double the density of nests on all (mowed and unmowed) unmanaged control plots, which are considered "typical" unseeded roadsides on the study area.

Density of successful (hatched) nests on seeded plots for the 7 years (0.8 successful nest per acre) was more than double the density of successful nests on all unmanaged control plots (0.4 successful nest per acre). The density of successful nests on seeded plots ranged between 0.5 and 1.1 nests per acre during the 7 years. The density on mowed unmanaged control plots varied between 0.0 and 0.4 successful nest per acre and averaged 0.2 nest per acre for the 7 years; unmowed unmanaged control plots hatched from 0.4 to 1.1 nests per acre during the period and 0.6 nest per acre for all years combined.

3. Factors Influencing Distribution and Abundance of Pheasants

W. L. Anderson, D. R. Vance

To obtain additional information on relationships between chemical elements and the distribution of pheasants in Illinois, blood and selected internal organs from 10 adult hens, collected during August 1969, were spectrographically analyzed for calcium, magnesium, phosphorus, potassium, and sodium, plus 23 trace elements. Five of the hens were collected at Neoga (poor pheasant range) and five were taken at Sibley (good range). The blood and liver from each hen were analyzed individually; the other internal organs (gizzard lining, gizzard muscle, heart, kidneys, lungs, pancreas, and spleen) were pooled according to type of organ, then analyzed.

It was found that mean concentrations of chromium and magnesium in blood were greater, and those of molybdenum, silver, and tin in livers were less, in hens from Neoga than in hens from Sibley. All of these differences were statistically significant ($\underline{P}$ <0.05). Of these five elements, only molybdenum appears to be potentially important in limiting the abundance of pheasants at Neoga. However, in view of the fact that the mean concentration of molybdenum in livers of the Neoga hens was 0.65±0.03 ppm (compared with 1.20±0.24 ppm for Sibley hens), it is doubtful that these birds were suffering from a shortage of this trace element. Thus, it is tentatively concluded that hen pheasants at Neoga probably do not suffer from gross imbalances of chemical elements during the summer months.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, P. J. Matthews

Prehunt censuses of quail were conducted on the Forbes and Dale areas in late October and early November, 1969. Results of these censuses revealed that the fall population on Forbes (26 quail per 100 acres) was the highest ever recorded on the area and exceeded the previous population high (prehunt 1968) by 15 percent.

Quail density in the experimental management zone on Forbes was 65 birds per 100 acres, a decrease of 32 percent from 1968. A 250-acre zone on Forbes, managed by the food-patch method by the Division of Game from 1963 through 1967, was incorporated into a sharecropping program in 1968. Quail density on this zone increased from 14 birds per 100 acres in 1968 to 71 birds per 100 acres in 1969.

A population density of 37 birds per 100 acres was recorded this fall on the Dale Area, a decline of 16 percent from 1968. The population in the zone managed solely by burning declined 36 percent from 1968. The population on the remainder of the Dale Area was 5 percent lower than in 1968.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

In 1968 a new booming ground became established on the 140-acre McCormick Sanctuary (former Zimmerman tract) at Bogota and presented the only instance up to that time where nesting cover completely encircled a booming ground (MWRL 11(12):3). Seven nests were subsequently found in a radial pattern encircling the ground at a mean distance of 246±14 (SE) yards. This was the first evidence suggesting the existence of a preferred zone for nesting relative to a booming ground.

In 1969 two widely separated sites (6 acres and 5 acres in size, each surrounded by nesting cover) were burned on February 26 on the McCormick Sanctuary. Two or three cocks were subsequently seen booming on each site and once again seven nests were found on this sanctuary. Distances for four nests relative to one booming ground averaged 183±35 yards and distances for three nests relative to the other ground averaged 220±12 yards. Also in 1969, a booming ground became established on a 5-acre plowed strip that extended across the center of the 77-acre Yeatter Sanctuary. Except for a 56-yard opening at one end of the plowed strip, the Yeatter booming ground was also surrounded by nesting cover. The six

nests found on the Yeatter Sanctuary were placed at a mean distance of 243 ± 47 yards from the booming ground in a radial pattern similar to those on the McCormick Sanctuary.

The mean distance of 229 ± 16 yards for the 20 nests associated with the four booming grounds thus strengthens the concept of a preferred zone for nesting. In 95 percent of similar situations involving booming grounds surrounded by nesting cover, the mean distance between a ground and its associated nests should range between 213 and 245 yards. Curiously, none of the four grounds described was on a traditional booming site and in no instance were large numbers of cocks involved. Three of the four grounds were categorized as booming grounds of uncertain status because of (1) the small number of cocks involved and (2) the irregularity of their presence from day to day and from time to time on any given morning.

6. Rabbit Management

G. B. Rose

The annual fall censusing of cottontail rabbits on the 100-acre (40-hectare) 4-H Area at Robert Allerton Park is being continued this fall, the 14th successive year. One hundred six rabbits were trapped and ear-tagged, and the tails of 87 were dyed, during a 10-day period at the beginning of November.

On November 22, Dr. H. H. Shoemaker's wildlife management class helped conduct a drive through the area, during which a record was kept of the number of observations of rabbits with dyed and with undyed tails. A Lincoln Index estimate of the population for November, based on the numbers of marked and unmarked rabbits seen, was 288 rabbits on the study area.

Several population estimates were calculated from the capture and recapture data. The Schnabel (short form) estimate is 149 animals; the geometric maximum likelihood estimate (MLE-G) is 282; and the maximum likelihood estimate from a regression of the logarithm of the number of individuals in a frequency class on frequency of capture (MLE-R) is 278. The MLE-R is regarded as the best method of estimation (MWRL 12(10):3).

The Schnabel, MLE-G, and MLE-R estimates are only slightly smaller than the corresponding estimates for October 1969 (157, 288, and 279, respectively). An MLE-R estimate for November of the 131 rabbits that were handled in October was 129; thus, mortality during the month of October has been negligible.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois December, 1969 Vol. 12, No. 12

1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

Beginning in the fall of 1968, a belated attempt was made to determine the effect of marking pheasants with plastic (fiberthin and coverlite) back tags. In this attempt, half of the juvenile cock pheasants captured during the fall trapping period were marked with back tags and bands and half were marked with bands only. Tags and bands, and bands only, were put on alternately, so that the effects of differences in locations and dates of capture were minimized. Adult cocks were excluded from the test sample because of the small numbers captured and the possibility of differences in recovery rates related to age.

During the hunting season of 1968, 13 cocks with tags and bands and 12 cocks with bands only were shot and were reported to project personnel. To date (December 20), three additional cocks with tags and bands and three cocks with bands only, from the 1968 trapped sample, have been reported shot during the hunting season of 1969. Nine cocks with tags and bands and 11 cocks with bands only, from the 1969 trapped sample, have been reported shot thus far.

Although the sample size is small (a total of 25 cocks with tags and bands and 26 cocks with bands only, during the 2 years), these data suggest that back tags have little effect on the survival of juvenile cock pheasants. Whether these findings are also indicative of the effect of tags on hen pheasants is unknown. Because of the absence of an unbiased means of recovering marked hens, continuation of the present study appears to be the only means for testing the effect of back tags under field conditions.

2. Manipulation of Roadside Habitat

G. B. Joselyn

In the spring of 1968, the Illinois Division of Highways, the Natural History Survey, and the Department of Conservation undertook a cooperative project for experimental management of roadside cover along Highway 47 in Ford and Livingston counties. This is a study of the feasibility of managing vegetative cover along a state primary highway to benefit song and game birds: cover that is compatible with the basic objectives of roadside maintenance operations and the safe, orderly movement of vehicular traffic.

The investigation in Ford and Livingston counties has been dealing with two different types of treated roadside segments:

1. Three, 1-mile segments, between Gibson City and Strawn, seeded on both sides with a combination of smooth brome (*Bromus inermis*) and alfalfa (*Medicago sativa*) from the ditch to the fence and left unmowed.

2. A 2.25-mile segment of roadside, north of Strawn, where the existing vegetation composed primarily of bluegrass (<u>Poa</u> spp.), some K-31 fescue (<u>Festuca</u> sp.), and forbs was left unmowed from the ditch to the fence. Portions of this segment were fertilized at the beginning of the study and some portions were sprayed in an attempt to control broadleaf weeds during the summer of 1968; all of the segment was treated for weed control in 1969.

The highway was driven at periodic intervals in an attempt to detect any differences in the frequency of pheasant roadkills adjacent to the unmowed segments as compared with nearby control miles where normal mowing practices were carried out. During 1969, only 34 roadkilled pheasants were found. This is a substantially smaller annual sample than is desired to make a valid statistical test of the effect of unmowed roadside seedings on the frequency of pheasant roadkills.

The brome-alfalfa seedings can be considered a success. During the summer of 1969, the seeded segments presented a relatively weed-free, uniform, and pleasing appearance. This opinion is shared by personnel from the Ottawa office as well as by the highway maintenance crews in Gibson City. No complaints from farm operators or the motoring public about the unmowed condition of the seeded roadsides have, to the knowledge of the investigator, been received. A proposal for expansion of this phase of the project has been submitted to the Division of Highways.

The 2.25-mile segment with unmowed existing vegetation presented some problems. The fertilizer application to some plots has had no visible effect on the vegetation; thus the stand of grasses did not benefit to the extent of a reduction in the occurrence of broadleaf weeds. Spraying for broadleaf weeds has also proved less than satisfactory. As a result, much of this segment has had an undesirable appearance, with attendant protests from some farm operators. Improved equipment and application techniques, and utilization of different chemicals, may increase the efficiency of the weed-control program. However, a review of this phase of the project by cooperating agencies is recommended.

3. <u>Factors Influencing Distribution and Abundance of Pheasants</u>

W. L. Anderson,
D. R. Vance

Although the studies of possible effects of inorganic ions on the distribution and abundance of pheasants in Illinois have involved analyzing various materials (soil, grit, corn, and pheasant tissues) for 22 to 62 chemical elements, several important elements have not been included in the analyses for one reason or another. One of these is sulfur, an essential major element. Therefore, 10 samples each of soil, unsorted grit (all grit 2-6 mm in diameter that occurred in soil), and calcitic grit (grit that is predominantly calcium carbonate) from Sibley (good pheasant range) and corresponding samples of these materials from Neoga (poor range) were analyzed for sulfur. This element averaged 335±26 and 358±22 ppm in soil, 251±26 and 443±63 ppm in unsorted grit, and 557±42 and 634±76 ppm in calcitic grit in samples from Sibley and Neoga, respectively. These findings suggest that inorganic sulfur is not deficient in poor pheasant range in Illinois.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, P. J. Matthews

The vegetative response to a "cool" burn was demonstrated on a plot on the experimental management zone on the Forbes Area in 1969. A "cool" burn is, as the name implies, a fire that burns slowly in an area with little fuel or when the humidity is high and there is little or no wind.

This particular plot on the experimental management zone is typical of much agricultural land in southern Illinois, characterized by low natural fertility and poor drainage. In 1966, three-fourths of the plot was in soybeans (Glycine max) and one-fourth in unharvested corn (Zea mays). The area in soybeans was seeded to oats (Avena sativa) the following spring (1967), and one-third of the area in oats was seeded to redtop (Agrostis alba) and one-third to red clover (Trifolium pratense). In mid-February 1969, one-third of the entire plot was burned (the burn cut across all types of cover present on the plot) and quadrat samples of the vegetation were taken in August in the burned and nonburned portions.

There was little difference in the amount of bare ground recorded in the burned (24 percent) and nonburned (23 percent) portions of the plot. Totals of 20 and 23 plant species were recorded in the burned and nonburned portions, respectively; 15 species were common to both portions. The similarity of vegetative composition of the two samples was 54 percent. The burned portion, however, contained almost twice the amount of common ragweed (Ambrosia artemisiifolia) as the nonburned portion. In terms of quail management, this positive response by common ragweed was possibly the only beneficial result of the "cool" burn; however, for quail management, areas of this type can be more effectively managed by sharecropping.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

The nesting study on the Bogota Area in 1969 once again demonstrated the value of the sanctuaries as production areas for numerous species of wildlife in addition to prairie chickens. Besides the 28 prairie chicken nests (64 percent hatched) found in a search of 347 acres of sanctuary grasslands, nests of 14 other species of birds were represented as follows: redwinged blackbird (Agelaius phoeniceus), 292 nests; eastern meadowlark (Sturnella magna), 118; bobwhite quail (Colinus virginianus, 58; dickcissel (Spiza americana), 47; mourning dove (Zenaidura macroura), 31 (ground nests); field sparrow (Spizella pusilla), 10; grasshopper sparrow (Ammodramus savannarum), 9; Henslow's sparrow (Passerherbulus henslowii), 1; song sparrow (Melospiza melodia), 1; short-billed marsh wren (Cistothorus platensis), 7; indigo bunting (Passerina cyanea), 2; upland plover (Bartramia longicauda), 2; goldfinch (Spinus tristis), 1; and ring-necked pheasant (Phasianus colchicus), 1. Parasitism by the brown-headed cowbird (Molothrus ater) was noted in a redwing nest and in a field sparrow nest.

As indicated by the above listing, redwings and meadowlarks continue to be the most abundant nesting birds on sanctuary grasslands, with bobwhites ranking third in abundance. Hatching success for 56 quail nests, including 13 empty nests, amounted to 33 percent in 1969. One oddity was found--a hatched prairie chicken nest which also contained two hatched quail eggs.

6. Rabbit Management

G. B. Rose

The annual fall censusing of cottontail rabbits on the 100-acre (40-hectare) 4-H Area at Robert Allerton Park is being continued this fall, the 14th successive year. Seventy-four rabbits were trapped and ear-tagged during a 10-day period at the beginning of December.

Several population estimates were calculated from the capture and recapture data. The Schnabel (short form) estimate is 85 animals; the geometric maximum likelihood estimate (MLE-G) is 172; and the maximum likelihood estimate from a regression of the logarithm of the number of individuals in a frequency class on frequency of capture (MLE-R) is 156. The MLE-R is considered the best method of estimation (MWRL 12(10):3).

The Schnabel, MLE-G, and MLE-R estimates for December are much smaller (39 to 44 percent) than the corresponding estimates for November 1969 (149, 282, and 278, respectively). Thirty-seven rabbits were removed by hunting during November. The estimates of nonhunting mortality range from 24 to 35 percent. Thus, while mortality during October was negligible (MWRL 12(11):3), mortality during November was high.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | January, 1970 | Vol. 13, No. 1

1. Pheasant Populations and Land Use — S. L. Etter, R. E. Greenberg

During the fall trapping periods of 1962-68, 63 tagged hen pheasants were recaptured on the Sibley Study Area. Twenty-four of these hens were captured after their first nesting season; 39 were captured after their second or later nesting seasons. The length of the most recently molted primary feather was recorded for each bird. Based on the assumption that the rate of molt and rate of growth of the primary wing feathers of adult hens were equal to those of juvenile hens, the dates of molt initiation were obtained by backdating from the date of capture.

The earliest dates of molt initiation for first-season and older hens were the weeks of July 2-8 and June 25-July 1, respectively. The latest dates of molt initiation for first-year and older hens were the weeks of August 13-19 and August 27-September 2, respectively. Sixty-two percent (15) of the first-year hens began their wing molt between July 16 and 29, compared with 46 percent (18) of the older hens.

Although the sample sizes involved are small, these data suggest that initiation of molt among older hens occurs over a longer period of time than among hens in their first nesting season. Based upon the general agreement of the initiation of wing molt in hens and their broods, it has been suggested that nesting hens begin molting approximately 4 weeks after their clutches hatch. If this is the case, the wing molt data are in close agreement with data obtained from tagged hens observed with broods (MWRL 12(6):1), which indicated that the nesting effort of older hens is more prolonged than that of hens in their first nesting season.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

The unmowed backslope areas making up the 2.25 miles of typical (unseeded) roadsides along Highway 47 (MWRL 12(12):1) presented some problems during 1968 and 1969. Fertilizer applications to some plots had no discernible effect on the vegetation. It was felt that improving the fertility of the backslope area to promote the growth of grass might effect some measure of broadleaf weed control, but the occurrence of broadleaf weeds was not visibly reduced on the fertilized areas.

Spraying for broadleaf weeds on this project has given unsatisfactory results. Inadequate equipment and the relatively weak 2,4-D amine used in 1968 in selected plots resulted in a rather narrow spectrum of weed control. A

reasonable degree of control was obtained over goat's beard (Tragopogon spp.), an early-blooming weed on the roadsides, but little, if any, control was evident over wild carrot (Daucus carota), which blooms later in the summer. In 1969, when all plots were sprayed 3 weeks later than in the preceding year, with the more potent 2,4-D ester, good control of goat's beard resulted, but the wild carrot again appeared largely unaffected. It is not immediately evident why the wild carrot was not killed, especially in 1969, unless spraying operations were too early or application rates were insufficient.

Regardless of the reasons for the inadequate control of broadleaf weeds, the reactions of at least two farm operators, whose lands adjoin the roadsides, were adverse. The other five farmers with lands along the unseeded roadsides expressed no opposition to the project; neither did they display any enthusiasm for it. This raises the question whether attempts to manipulate existing vegetation on highway roadsides, with chemicals and fertilizer alone, would give results acceptable to adjacent farm operators if such roadsides were left unmowed.

3. Factors Influencing Distribution and Abundance of Pheasants

W. L. Anderson,
D. R. Vance

Previous research has demonstrated that sternal muscles are heavier, on the average, for pheasants from Neoga (poor pheasant range) than for pheasants from Sibley (good range). (See MWRL 10(4):2 and MWRL 11(4):2.) This was true for both actual weights of the muscles and for their weights expressed as percentages of body weight. It was thought that one plausible explanation for this difference between Neoga birds and Sibley birds was that muscles from the former might contain proportionately greater amounts of water. Therefore, sternal muscles from 10 juvenile hens (February 1968) and from 5 adult hens (August 1969) collected at Neoga and from the same numbers of hens collected at Sibley were analyzed for water content. The analyses were performed by toluene-entrainment distillation, conducted at Stewart Laboratories, Inc., Knoxville, Tennessee.

The concentrations of water in sternal muscles averaged 68.6 ± 0.6 percent for juvenile hens from Neoga and 69.2 ± 0.7 percent for juvenile hens from Sibley. Similarly, the water content of muscles from adult hens from Neoga and Sibley averaged 70.2 ± 0.3 and 70.4 ± 0.6 percent, respectively. These findings suggest that the relatively heavy weights of sternal muscles from Neoga pheasants were caused by factors other than the proportionate amounts of water they contained.

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis,
P. J. Matthews

Hunters harvested 370 quail on the Dale Area in 1969--more than in any previous year. The harvest in 1969 exceeded that of 1968 by 3 percent, and was achieved with the expenditure of 7 percent fewer gun-hours.

On the Forbes Area, 373 quail were harvested in 1969, a decline of 33 percent from the harvest of 559 birds in 1968, the highest ever recorded on the area. Although the harvest was lower in 1969 than in 1968, the hunting effort (gun-hours) was 5 percent greater in 1969 than in 1968.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

Each of the seven booming grounds present on the Bogota Area during the spring of 1969 was systematically checked for prairie chicken activity during the late summer, fall, and early winter. As in past autumns and springs, the booming grounds were checked at about weekly intervals during the first hour after daybreak; efforts were also made to locate additional flocks (in other areas) and to determine the sex composition of all flocks located.

Although each of the seven booming grounds became suitable (four were made suitable deliberately by burning, plowing, or mowing) during the fall, only one ground on private farmland was active. Counts ranged from 9 cocks as early as August 11, to approximately 75 cocks by October on the main booming ground. Use of the present major booming ground (by seven cocks) was first noted in the spring of 1966. Then, for three falls and two springs, beginning with the fall of 1967, this ground has been the center of the home range of the Bogota flock. Nearly all, or perhaps all, of the cocks in the past three fall populations have visited the major ground in autumn. In the springs of 1968 and 1969, 43 percent and 63 percent of the cocks, respectively, have concentrated their booming activities on the main booming ground. Soil surface conditions on the major ground were as follows: fall 1967 through spring 1968, plowed ground; fall 1968, fallow disked ground and new wheat seeding; spring 1969, green wheat and soybean stubble; and fall 1969 to present, closely mowed legumes and fallow disked ground. The fields involved have ranged from 7 to 25 acres in size.

Thus, while recent observations indicate a second encouraging increase of approximately 40 percent in the population level, the concentration of the Bogota flock is a matter of concern. Booming grounds were dispersed over 3 Sections during the spring of 1969, but nesting sanctuaries are now established in 6 Sections. Accordingly, 10-acre portions of each sanctuary have been or will be burned, mowed, or plowed for booming grounds in an effort to promote a more efficient dispersion of the breeding population in 1970.

6. Rabbit Management — G. B. Rose

During the fall trapping period in 1969 on the 4-H Area at Robert Allerton Park, lengths and weights of captured cottontail rabbits were recorded on the first date of capture in each month, and weight-length relationships were used to calculate condition indices, using the formula: $C.I. = \frac{W - 16}{L^3}$, where W is the weight in grams and L is the length in decimeters (Bailey, J. A. 1967. MWRL 10(7):3). The mean condition index for October (121 animals) was 5.57, for November (104 animals) was 5.59, and for December (46 animals) was 5.76. The differences between means for October and November were not statistically significant at the 95 percent level of significance. The December mean was significantly greater than the November mean and highly significantly greater than the October mean. No statistically significant differences between means were detectable among the months October, November, and December, 1968 (MWRL 12(2):3-4), although Bailey had found highly significant differences among the months November through March during the years 1964 through 1967. The differences between the means for the months of fall 1969 and those for the corresponding months of fall 1968 were not significant.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson, Editor

NATURAL HISTORY SURVEY
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Urbana, Illinois February, 1970 Vol. 13, No. 2

1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

The estimated harvest of cock pheasants on the Sibley Study Area, based on changes in the sex ratio, indicates that 44 percent of the available cocks were killed during the 1969 hunting season. The estimated harvests on the study area in 1962, 1963, 1964, 1965, 1966, 1967 and 1968 were, respectively, 74, 75, 70, 46, 53, 36, and 54 percents of the available cocks.

During the period in which these data were obtained, hunting regulations varied considerably. In 1962, 1963 and 1964, three cocks were allowed in the bag. Two-cock bag limits were allowed in the following 5 years. Season lengths in 1962, 1963 and 1964 were 29½, 33½ and 36½ days, respectively. Season lengths in 1965, 1966, 1968 and 1969 were, respectively, 29½, 30½, 45½ and 46½ days. The 1967 season was originally set for 29½ days but was extended 14 days because of an extremely low kill resulting from large acreages of standing corn.

The higher harvest in 1962, 1963, and 1964, compared with later years, apparently resulted from a combination of higher population levels and the three-bird bag limits then in effect. A comparison of the harvests for 1965 and 1966 with those for 1968 and 1969, 4 years when population levels and hunting conditions were similar, suggests that the longer seasons in the latter 2 years had little effect on the harvest. These data suggest the tentative conclusion that pheasant hunting is largely self-limiting. Once the number of available cocks has been reduced to a certain level, the effort required to bag a bird apparently becomes so great that few hunters continue hunting no matter how liberal the prevailing regulations are.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

Available evidence suggests that unmowed backslope areas on highway roadsides adjacent to agricultural land must be kept relatively weed-free to prevent undesirable reactions from farm operators (MWRL 13(1):1). With regard to manipulation of vegetation now most common on the roadsides, it is also evident that any weed control program involving spraying with 2,4-D, with a few crews responsible for a sizable area, has inherent difficulties which jeopardize its chances for success. Our work over the past 2 years indicates that three sprayings are probably needed to adequately control broadleaf weeds. Two of these sprayings can be made during the period from late April to the end of May when few, if any, soybeans have emerged. However, at least one spraying should be made after June 1, when the chances of damaging

soybeans are much higher. Experience with spraying along secondary roadsides in the spring over the past several years has shown that wind velocities beyond those considered safe are the rule rather than the exception on most days from April through mid-June. Thus, a crew dealing with many miles of roadside would have to cover a rather large area on those days when wind conditions were favorable. On the other hand, section crews working relatively small areas might accomplish three sprayings with minimum risk. Also, there are probably more sophisticated and less volatile sprays than 2,4-D which can control roadside weeds with fewer than three applications and/or with a minimum risk.

Another point relating to unmowed backslope areas adjacent to agricultural land is to allow farmers to mow at their discretion after reasonable efforts have been made by the Division of Highways to control broadleaf weeds. This, in essence, is what took place on the typical highway roadside north of Strawn in 1969. By mid-August, virtually all backslope areas along the 2.25 miles had been mowed by farmers. Perhaps this is a means for dramatically reducing the mowing costs over large areas and at the same time allowing individual farmers to exercise some control over the appearance of the backslopes adjacent to their farms.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

Data compiled during the past 2 years indicate that, of 62 chemical elements investigated, sodium is the most likely to be limiting the distribution and abundance of pheasants in Illinois. Sodium, an essential ion, was the only element that was less abundant, Neoga (poor pheasant range) compared with Sibley (good range), in both unsorted grit (all grit found in soil) and in pheasants. The magnitude of the potential deficiency in unsorted grit from Neoga was by a factor of four: sodium averaged 10,600$\pm$2,600 ppm in samples from Sibley but only 2,400$\pm$1,300 ppm in samples from Neoga. Sodium was also the only element except lead that was less abundant in calcitic grit (grit that is predominantly calcium carbonate) from Neoga than in calcitic grit from Sibley.

Information in the literature suggests that corn and foxtail--and presumably many other grains and seeds--do not contain enough sodium to fulfill the minimal sodium requirements for pheasants. The sodium content of corn and foxtail averages 71$\pm$8 and 102$\pm$25 ppm, respectively, at Sibley, and 60$\pm$9 and 103$\pm$5 ppm, respectively at Neoga. Yet, growing pheasants require approximately 850 ppm of sodium in their diet. During the warmer months pheasants undoubtedly obtain appreciable amounts of sodium from green plants and invertebrates they consume. Red clover, for instance, contains an average of 800 ppm of sodium on a dry-weight basis. But, during the colder months, when their diet is predominantly grains and seeds, pheasants presumably would have to obtain sodium from inorganic sources. Unlike calcium, large quantities of physiologically-available sodium are not stored in the skeleton.

If the daily diet of a pheasant consists of 35 g of corn, the bird would have to obtain approximately 27,500 μg of sodium per day from sources other than the corn. To obtain this sodium from unsorted grit, the pheasant would have to consume 2.6 g of unsorted grit from Sibley or 11.5 g of unsorted grit

from Neoga and utilize all of the sodium in this grit. While it is possible that a pheasant could ingest 2.6 g of unsorted grit per day, it is inconceivable that a pheasant could consume as much as 11.5 g daily. It is also inconceivable that all of the sodium in the unsorted grit would be physiologically available to pheasants. Thus, unless pheasants are capable of selecting grit or other materials that are rich in sodium, this element appears to be deficient at Neoga during periods when the birds feed heavily on grains and seeds.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, D. R. Vance

For 32 consecutive days from December 23, 1969, to January 26, 1970, snow depth of 3 inches or greater occurred on the Forbes and Dale areas. Also, on several occasions temperatures were below 0^{o} F. Such extensive periods of snow cover are generally thought to be detrimental to quail. Posthunt censuses, completed in early February, when compared with the prehunt censuses and harvests on the study areas, indicated modicum population losses due to these conditions.

In early November, population densities of 26 and 37 quail per 100 acres were recorded on the Forbes and Dale areas, respectively. Hunters harvested 16 quail per 100 acres on Forbes, and the posthunt census indicated a population of 8 quail per 100 acres. A loss of 2 per 100 acres, or 20 percent, was attributed to normal winter mortality and the extreme weather conditions.

On Dale, hunters harvested 32 quail per 100 acres, and 9 per 100 acres were recorded during the posthunt census. These results indicated that we underestimated the November population, that birds migrated onto the study area after the prehunt census, or both, and that no population loss could be attributed to the weather conditions.

Covey sizes on both areas during the posthunt census were similar to those recorded in previous posthunt censuses. Thus, because of favorable habitat conditions, primarily extensive areas of woods, brush, and food patches, quail populations on Dale and Forbes survived the inclement period without excessive losses.

Mr. Paul Matthews, Assistant Project Leader since September, 1968, has resigned as of March 15, 1970, to accept a position in West Virginia. Mr. David Russel Vance, who has worked for the Survey on temporary, part-time, and full-time basis since June 1963 has been employed to replace Paul. Russ obtained a Master's degree at the University of Illinois in January, 1970.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

Prairie chicken booming grounds may be divided into "regularly used" and "uncertain status" categories. Generally, a booming ground of uncertain status involves less than five or six cocks and the cocks are highly irregular in their presence from day to day and from time to time on any given morning.

Grounds that are regularly used usually involve more than five or six cocks and the birds exhibit little temporal variation in their presence. The distinction between regularly used and uncertain status is made during the period when copulations are most commonly observed on the booming grounds. This period extends from late March through the first one-half of April in southern Illinois.

On the 16-square mile study area at Bogota during the 7-year period of 1963-69, distances between 49 booming grounds in both categories ranged from 0.31 mile to 1.56 miles, with a mean distance of 0.70 ± 0.05 mile. Distances between 32 regularly used booming grounds were from 0.34 mile to 1.84 miles with a mean of 0.84 ± 0.08, however, the means were not significantly different ($P > 0.05$). No correlation was found between the number of cocks using a booming ground and distances among booming grounds. Likewise, no correlation existed between the density of cocks on the study area and the mean distances among booming grounds during the 7-year period.

These data, along with a consideration of (1) the preferred zone for nesting in relation to a booming ground (240 yards, MWRL 12(11):2); (2) the optimum spacing among nests (120 yards, MWRL 12(2):3); and (3) the optimum size of a field suitable for booming (10 acres, MWRL 12(6):2) suggest that suitable sites for booming grounds should be spaced at distances of 600 yards on land that is available for prairie chicken management.

6. Rabbit Management

G. B. Rose

The estimation of the energy metabolized by animals in the field has proven to be a difficult problem for ecologists, for although the energy metabolism of caged animals can be readily measured, the rate of metabolism of caged animals may be quite different from that of animals in the wild. However, it appears that the measurement of the energy utilization of animals in the wild can be approximated by measuring the food consumption of animals in large outdoor pens. If the efficiency of assimilation of the food is known, then the energy assimilated can be calculated from the energy consumed. Furthermore, if adult animals for which growth is zero are used, then energy assimilated equals energy metabolized. In this way the energy metabolized can be estimated.

The amount of commercial rabbit chow eaten by six cottontail rabbits was measured during February, 1970. The outdoor pens in which the animals were kept were denuded of vegetation so that the rabbit chow was the only food consumed.

The rabbits in the outdoor pens consumed an average of 103 grams of food per day, which, with a 63 percent assimilation efficiency, represents an energy assimilation of 260 kilogram calories (Kcal) per day. This figure is greater than the average of 210 Kcal per day assimilated by rabbits kept in outdoor cages or the average of 162 Kcal per day assimilated by rabbits kept in indoor cages. Thus, the difference between the 260 Kcal per day assimilated by the rabbits in the outdoor pens and the 210 Kcal per day assimilated by the rabbits in the outdoor cages may be assumed to be the result of the greater

activity of the animals in the pens. Similarly, the difference between the 210 Kcal per day assimilated by the rabbits in the outdoor cages, and the 162 Kcal per day assimilated by those in the indoor cages may represent the greater energy required for maintenance by the animals at the lower outdoor temperatures.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson, Editor

NATURAL HISTORY SURVEY
APR 8 1970
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Urbana, Illinois March, 1970 Vol. 13, No. 3

1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

Anderson and Vance (MWRL 12(8):1-2) presented criteria for identifying Illinois pheasants as juveniles or adults by measuring the shaft diameter and total length of the proximal (innermost) primary feather. Because their sample sizes were small (68 hens and 34 cocks) we felt it would be worthwhile to investigate more fully the use of proximal primaries as age criteria for east-central Illinois pheasants.

We found that Illinois pheasants can be separated into adult and juvenile age-classes from the shaft diameter alone of the proximal primaries. Adults have larger proximal primaries than juveniles. A sample of 162 cocks collected during October and November, 1969, separated at 3.24 mm (0.1275 inch) with 96.3 percent accuracy, while a sample of 16 cocks collected during February, 1970, separated with 100 percent accuracy. Adult cocks have large proximal primaries with shaft diameters greater than those of all but the largest primaries of juvenile cocks.

A sample of 107 hens captured during January and February, 1970, separated at 2.86 mm (0.1125 inch) with 95.3 percent accuracy. Accuracy for hens was much lower (84.1 percent) when the same criterion was applied to a sample of 201 hens captured during October and November, 1969, due to the presence of late-hatched (July-August) juvenile hens which have larger proximal primaries than early-hatched juvenile hens. Since late-hatched juveniles survive from October to January less well than do older juveniles, separation improves greatly in January. Accuracy for aging hens can be improved in October-November by taking into account total length as well as shaft diameter. With shaft diameter plotted against shaft length, 92.5 percent accuracy was obtained when a separation line was drawn between point A (length 165 mm, diameter 2.79 mm or 0.110 inch) and point B (length 140 mm, diameter 3.05 mm or 0.120 inch).

2. Manipulation of Pheasant Habitat

G. B. Joselyn

During a recent meeting with personnel from the Division of Highways it was decided that the 2.25 miles of unseeded ("typical roadsides") (MWRL 12(12): 1) along Highway 47 north of Strawn would be dropped from the study currently underway.

It is the feeling of the Division of Highways that there is little to be gained by continuing this portion of the investigation because herbicides have

failed to adequately control broadleaf weeds with a resulting adverse reaction from some adjacent farm operators. The seeded segments will be retained for further studies of their possible effects on the frequency of pheasant-auto collisions, erosion control properties and the reaction of adjacent farm operators and the motoring public.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

This project was inactive during March.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis, D. R. Vance

The Forbes and Dale areas are separated by a distance of only 15 miles, and as such, have many environmental similarities. The respective quail populations manifest differences and similarities in many facets of population ecology. The chronology of hatching in 1968 and 1969 was one example of the differences and similarities between the two areas.

The dates of hatching were determined from the wings of juveniles harvested during the first 10 days of the hunting season in 1968 and 1969 (MWRL 11(6):2). During these 2 years on the Dale Area, less than 10 percent of the juveniles were hatched after September 1. On the Forbes Area, however, 20 percent of the juveniles each year were hatched after September 1. The calculated frequency of dates of hatching early (prior to July 1) in the nesting season were similar; approximately 30 percent of the juveniles from the areas each year were hatched prior to July 1.

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier

The increase in the population level of the Bogota flock amounted to 38 percent in 1968, and preliminary data for this spring indicates that an increase of approximately 80 percent occurred as a result of successful nesting in 1969. These recent gains took place even though nesting hens utilized less than one-half of the total sanctuary acreage of 687 acres. An additional 245 acres of the total acreage will be available as nesting cover in 1970 because (1) all portions of recently acquired sanctuaries now have well-established cover and (2) it is hoped that prairie chickens disperse to sanctuaries previously outlying their home range. Each year about 15 percent of the total sanctuary acreage will not be available as nesting cover because of the need for providing suitable booming sites and renovating old sods. The loss of nesting cover resulting from provision of booming sites is more than offset because, as recent research on the behavioral ecology of prairie chickens indicates, a booming ground surrounded by a variety of nesting cover makes the most efficient use of the limited acreage of sanctuaries. Thus, because of the newly available nesting cover and because the Bogota flock is still far below the carrying capacity of the sanctuary system, there is good reason to expect a continued upward trend in the population level.

6. Rabbit Management

G. B. Rose

In livetrapping of cottontail rabbits on the 4-H Area at Robert Allerton Park, a total of 1,272 animals were captured during the years 1956-1965. Of these 1,272 animals, 85 were recaptured the second year, 14 were recaptured the third (but not necessarily the second) year, 2 the fourth year, and 3 the fifth year. The annual mortality rate of adult cottontails, calculated from a regression based on the logarithms of numbers of animals recaptured in successive years after the first year or year of capture is 67 percent. This is considerably less than the 85 percent mortality of juvenile cottontails from one fall to the next. Turnover time for the rabbit population at Allerton is about five years.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | April, 1970 | Vol. 13, No. 4

NATURAL HISTORY SURVEY
MAY 7 1970
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1. Pheasant Populations and Land Use — S. L. Etter, R. E. Greenberg

In an earlier report (MWRL 9(3):1) it was pointed out that changes in the age ratios of pheasants captured by nightlighting during fall (October and early November) and winter (January and February) indicated that the survival of juvenile pheasants was considerably lower than that of adults during the interim period. Examination of the observation rates of tagged juvenile and adult birds during these same 4 years (1962-65) indicated agreement with the conclusions drawn from the nightlight data in that the observation rates of tagged juvenile pheasants during the winter after capture were significantly lower ($P < 0.05$) than those of adults. The age ratios of tagged pheasants observed in winter (January through March) and spring (April through June) for the years 1962-66, however, were nearly equal and failed to show any significant differences.

These data suggest that the higher mortality rate of juvenile pheasants compared with that of adults is confined to the late fall and early winter periods. Although cause-and-effect relationships cannot now be demonstrated, it is tempting to speculate that the drastic habitat changes which result from the corn harvest and fall plowing are more detrimental to juveniles than to adults. Once this critical period has passed, the remaining juvenile pheasants apparently survive equally as well as adults.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

Because of the shortage of rainfall during late summer and fall, 1968, it was felt that the success of the roadside seedings on the Ford County Management Unit was in jeopardy (MWRL 12(2):1). After a spring with adequate moisture, a check of the roadsides during summer 1969 indicated the possibility of better success with the seedings than had been anticipated (MWRL 12(7):1).

Accordingly, the Game Division is preparing a letter to be sent to each of the cooperating farmers on the area requesting them to refrain from mowing their roadsides (with the exception of a narrow strip along the outside edge) until on or after July 31, beginning this year. All cooperating farm operators agreed to such an arrangement at the time they were contacted by District Biologists prior to the establishment of the seedings. However, because of the uncertain status of the seedings last year, farmers were notified to mow at their discretion during 1969.

Sometime in May, signs will be erected on each road entering the 16-square-mile area to inform the public about the seedings and why the roadsides are not mowed.

3. Factors Influencing Distribution and Abundance of Pheasants — W. L. Anderson

This project was inactive during April.

4. <u>Responses of Bobwhites to Habitat Manipulation</u> J. A. Ellis, D. R. Vance

One of the problems associated with programs of prescribed burning is establishment of firebreaks. We now believe that discing, in the fall, around areas that are scheduled to burn during the following spring is the most efficient and economically feasible method of establishing firebreaks. In the fall of 1969, firebreaks were disced around six plots (113 acres) in the experimental management zone on the Dale Area. The size of the plots ranged from 2 to 64 acres, and the estimated cost of discing varied from $1.90 per acre for the 2-acre plot to $0.64 per acre for the 64-acre plot. The costs were calculated on the basis of $12.00 per hour for tractor, disc, and operator. The economic advantages of burning a few units of large acreages rather than many units of small acreages are readily apparent.

5. <u>Responses of Prairie Chickens to Habitat Manipulation</u> R. L. Westemeier

Booming ground surveys were conducted on the Bogota Study Area since mid-August 1969 at approximate weekly intervals (more frequently in early April 1970) during the first hour after daybreak, and an effort was made to determine the maximum number of cocks on the area. The number of prairie chicken cocks involved in booming activities appeared to increase gradually from late summer 1969 through the subsequent fall and winter. The peak count of 108 cocks on April 5 amounts to a 112 percent increase since the spring of 1969, and thus surpasses previous predictions (MWRL 13(1):3 and MWRL 13(3):2). The count this spring is 38 percent higher than the previous high made in 1963, when this census was initiated, and 192 percent higher than the low year of 1968. A more favorable dispersion of the breeding population was also noted this spring, compared with 1969. In the spring of 1969 seven booming grounds were found in 3 Sections on or near six sanctuaries. This spring, booming was observed in 12 general areas in 6 Sections and on all but 1 of the 10 sanctuaries at Bogota.

6. <u>Rabbit Management</u> G. B. Rose

The energy assimilated by cottontail rabbits was estimated in the same way as described in MWRL 13(2):4-5.

The rabbits in the outdoor pens consumed an average of 96 grams of rabbit chow per day, which, with a 63 percent assimilation efficiency, represents an energy assimilation of 241 kilogram calories (kcal) per day. This is a greater assimilation than the 206 kcal per day assimilated by rabbits kept in outdoor cages. Thus, the difference between the 241 kcal per day assimilated by the rabbits in the outdoor pens and the 206 kcal per day assimilated by the rabbits in the outdoor cages may be assumed to be the result of the greater activity of the animals in the pens. These figures for energy assimilation for April are only slightly less than the corresponding figures of 260 kcal per day and 210 kcal per day for late February and early March, and probably reflect somewhat higher requirements for thermoregulation at between 20 F and 55 F in February and March than at between 50 F and 75 F in April.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois — May, 1970 — Vol. 13, No. 5

1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

During the period April 27-May 6, 1970, systematic counts of pheasants were conducted along 57 miles of all-weather roads on the Sibley Study Area. Each observation period was confined to the first 2 hours after sunrise, which allowed coverage of half the roads each morning. Thus, in eight mornings each road was driven four times for a total of 228 miles. Starting points were staggered so that no one portion of the study area was consistently covered earlier than other portions. Counts conducted during the period April 16-28, 1969, followed these same criteria.

These counts revealed little difference in the numbers of cock pheasants observed in 1969 and 1970. The counts in 1970 recorded 238 cocks (104 per 100 miles); 243 cocks (106 per 100 miles) were recorded in 1969. Winter sex ratios obtained during periods of snow cover in 1969 and 1970 were 36 and 40 cocks per 100 hens, respectively. By using these figures, indices of 675 and 595 hens were calculated for 1969 and 1970, respectively, a decrease of 12 percent.

In view of the fact that the standardized counts of pheasants in July and August 1969 were higher than in 1968 (MWRL 12(9):1), the lower breeding population in 1970 suggests that the survival rate of pheasants during the winter of 1969-70 was somewhat lower than it was during the winter of 1968-69. Thus, the prolonged period of snow cover during this past winter, compared with the relatively open winter of 1968-69, may have had an adverse effect on pheasant survival.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

On May 12, letters were sent to the cooperating farmers on the Ford County Management Unit requesting them to refrain from mowing their roadsides until on or after July 31. It was indicated that there were no objections to mowing a narrow strip along the edge of the roadsides or around field entrances and lanes to provide a clear view of traffic.

On May 15, signs were erected at each road entering the 16-square-mile area. The 20- by 14-inch steel signs read:

EXPERIMENTAL ROADSIDE
MANAGEMENT AREA

Roadsides remain unmowed and have been seeded with the co-operation of farm operators and for the associated benefits of all wildlife species
Illinois Department of Conservation
Illinois Natural History Survey
Co-operating

In mid-May, a check of roadsides on the area showed generally good stands of brome and alfalfa throughout the Management Unit. In some locations, however, the stands of the seeded species were inadequate or of lower quality than desired. Weeds thus far in evidence that may cause concern to farmers are goatsbeard (*Tragopogon* spp.) and curled dock (*Rumex crispus*); both species occur at scattered locations but are mostly confined to roadsides having the poorer stands of brome and alfalfa. It is anticipated, based on the experience with seeded roadsides at Sibley, that the occurrence of goatsbeard will diminish as the seedings age. The curled dock presents a somewhat more difficult problem, however.

3. Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

The possibility that pheasants and other game birds carry dangerous levels of mercury recently came into sharp focus in Alberta, Canada, where pheasants and Hungarian partridges were found to carry concentrations as high as 0.47 ppm of the metal. Similar findings have been reported for pheasants and partridges in Montana. The tolerance level for mercury in human foods, as suggested by the World Health Organization, is 0.05 ppm. The pheasants and partridges in Alberta and Montana apparently became contaminated with mercury by eating seed grain treated with organic mercury fungicides.

When news of the "mercury scares" in Alberta and Montana broke, it was reassuring that, in Illinois, we had previously analyzed tissues of pheasants for mercury and had found none in the birds. Blood, liver, kidneys, and other internal organs from 20 juvenile hens, collected in Ford, Livingston, and Cumberland counties during February 1968, were analyzed for mercury (and 61 other chemical elements); the lower limit of detection was 0.10 ppm on a wet-weight basis. Because trace elements are known to concentrate in the liver, kidneys, and certain other internal organs, any mercury in the pheasants would appear in one or more of these organs before contaminating the edible portions of the birds. The analyses were conducted during an investigation of the possible effects of chemical elements on the distribution and abundance of pheasants in Illinois (MWRL 11(12):2 and MWRL 12(2):2).

This is an excellent example of the practical value of basic information when situations such as "mercury scares" arise. Mercury contamination and many other problems associated with wildlife usually cannot be predicted. It is frightening that we know practically nothing about the presence and concentrations of mercury and other toxic elements in our other common game species.

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis, D. R. Vance

Results of the prebreeding censuses of quail, conducted on the Dale and Forbes areas in early March 1970, revealed declines in the populations when compared with population levels found in March 1969. In 1969, the prebreeding populations were 7.3 and 12.7 quail per 100 acres on Forbes and Dale, respectively. During the prebreeding censuses in 1970, 12 coveys containing 109 quail (4.6 quail per 100 acres) were located on the Forbes Area and 10 coveys with 110 quail (10 quail per 100 acres) were found on the Dale Area. The prebreeding populations in 1970 represented declines of 37 percent and 21 percent for the Forbes and Dale areas, respectively, from the prebreeding populations in 1969.

The size of the prebreeding populations has been statistically correlated ($P < .005$) with the size of the subsequent prehunt populations when the data from both areas were combined. When these data were considered independently for each area, the correlations were not significant. We can expect, therefore, that the prehunt populations in 1970 on Forbes and Dale will not exceed the prehunt populations of 1969.

5. Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier

During the period of late March to mid-April, 1970, booming ground surveys were conducted in 12 areas in seven counties in south-central Illinois. The census areas in 1970 included all areas of the state still thought to contain flocks of five or more prairie chickens. An effort was made to determine the maximum number of cocks on each area.

A total of 189 prairie chicken cocks were counted on 8 of the 12 areas censused. The Bogota Area now contains 57 percent (108 cocks) of the statewide population and showed an increase of 112 percent since the spring of 1969 (MWRL 13(4):2). The remaining 81 cocks found in seven areas outlying the Bogota Area represent a loss of 9 percent from the 89 cocks found in 1969. The losses between 1969 and 1970 were greatest near Loogootee (24 cocks to 17 cocks) and Hoyleton (8 cocks to 4 cocks). Counts remained essentially unchanged in Marion County near Farina (28 cocks), Forbes Park (13 cocks), and Fairman (4 cocks), and in Fayette County near La Clede (3 cocks). Higher counts were noted on only one of the outlying areas--the area near Mt. Erie in Wayne County--which increased from 5 cocks in 1969 to 12 cocks in 1970.

Thus, the prairie chicken population on the Bogota Area remains in sharp contrast to the remaining flocks in Illinois. If a 50:50 sex ratio is assumed, the statewide population numbered about 378 prairie chickens this spring.

6. Rabbit Management

G. B. Rose

The energy assimilated by cottontail rabbits was estimated as described in MWRL 13(2):4-5.

Rabbits maintained in outdoor pens during May 1970 consumed an average of 116 grams of rabbit chow per day, which, with an assimilation efficiency of 63 percent represents an energy assimilation of 292 kilogram calories (kcal) per day. This is greater than the 187 kcal per day assimilated by rabbits kept in outdoor cages and probably reflects the greater activity of the animals in the pens.

The energy assimilation of the caged animals in May is less than that for late February and early March (210 kcal per day) or April (206 kcal per day), while the energy assimilation of the penned animals in May is greater than that for late February and early March (260 kcal per day) or April (241 kcal per day). Thus, no seasonal trend in energy assimilation can yet be discerned from the data.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

NATURAL HISTORY SURVEY
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Urbana, Illinois — June, 1970 — Vol. 13, No. 6

1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

During the spring of 1969, observations were made to investigate the hypothesis that adult hens begin nesting earlier than yearlings. Hens were usually observed, in plowed fields, as a harem accompanied by a cock. The "disappearance" of hens during May was believed to be related to their leaving the harem at the onset of incubation. A total of 63 observations of back-tagged hens were obtained between April 16 and May 29. Birds had been captured during the fall of 1968 and marked with back tags color-coded by age-class.

The proportion of back-tagged hens observed that were adults remained stable at 60 percent during the last 2 weeks of April and then declined gradually during May. The proportion of adults had decreased to 50 percent of the back-tagged hens observed during the second week of May and, by the last week, no back-tagged adult hens were seen. Analysis by linear regression revealed that the decline in the proportion of adult hens observed, by weeks, was statistically significant ($\underline{t} = -3.95$, df = 5, $\underline{P} < 0.05$) during the spring of 1969. However, a check of data from past years (1966, 1963, and 1962) revealed no such relationship.

2. Manipulation of Pheasant Habitat

G. D. Joselyn

In 1970, the first search for pheasant nests on manipulated and on managed control plots along 9½ miles of roadway on and near the Sibley Study Area was conducted during the period June 15-19. Sixty nests were located on the plots, 37 on seeded and 23 on managed control plots. This represents a sizable increase in the numbers of nests on both types of roadsides over the numbers of nests found during the first search in 1969, when 22 nests were located on seeded plots and 16 on managed control plots. The first search in previous years produced the following results: 1968, 59 nests (seeded, 36; managed control, 23); 1967, 52 nests (seeded, 30; managed control, 22); 1966, 70 nests (seeded, 44; managed control, 26); 1965, 57 nests (seeded, 35; managed control, 22); 1964, 85 nests (seeded, 52; managed control, 33); and 1963, 80 nests (seeded, 40; managed control, 40).

3. Factors Influencing Distribution and Abundance of Pheasants

W. L. Anderson

It was previously reported that, of 32 chemical elements investigated, sodium is the most likely element to be limiting the distribution and abundance of pheasants in Illinois (MWRL 13(2):2). Sodium was the only element that was

less abundant, Neoga (poor pheasant range) compared with Sibley (good range), in both grit and in pheasants. Because of these findings, additional samples of pheasant tissues are currently being analyzed for selected elements. Ten juvenile hens each were collected at Neoga and at Sibley on February 4-13, 1970, and dissected; leg bones (femur, fibula, and tibio-tarsus), sternal muscles (pectoralis thoracica, supracoracoideus—ventral head, and coracobrachialis posterior), and the liver from each bird were saved. These tissues are being analyzed for sodium, calcium, magnesium, phosphorus, and potassium by Stewart Laboratories, Inc., Knoxville, Tennessee. Although this project was terminated on June 30, 1970, the results of these analyses will be reported in the MWRL as soon as they become available.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, D. R. Vance

A preliminary study of the effects of prescribed burning, used for quail management, on small mammal populations was conducted by Paul Matthews in 1969. Livetrapping in burned and in unburned (control) old field habitat showed *Peromyscus leucopus* and *Microtus ochrogaster* to be the two most abundant species. Prior to the burning, the population of *Peromyscus* on control areas was apparently about three times that on burn areas (6.22 vs 2.21 captures per 100 trap-nights). Three weeks after burning (March 4, 1969) there were 2.86 and 4.52 captures per 100 trap-nights on control and on burned areas, respectively. Populations of *Microtus* prior to burning were about the same on control and on burn plots (1.78 vs 1.43 captures per 100 trap-nights). No *Microtus* were trapped on either control or burned areas after the prescribed burning, until June. These limited data suggest that, in this instance, prescribed burning in early spring did not adversely affect populations of *Microtus* or *Peromyscus*.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

A knowledge of dispersion patterns of booming grounds and of the characteristics of booming ground sites are two factors basic to the management of prairie chicken sanctuaries. During the period of 1963-69, the distances between 32 regularly used booming grounds at Bogota had not been closer than about 600 yards. The size of the "openings" or fields on which these booming grounds were located were no smaller than about 10 acres.

This spring, six of the eight regularly used booming grounds at Bogota had a spacing and field size similar to those during the period 1963-69. However, two booming grounds were as close as 300 yards and both were on sites only 5 acres in size. Twelve cocks boomed on 5 acres of undisturbed redtop and timothy (mixed) that had been flattened by snow, and five cocks boomed on 5 acres of weedy timothy that was burned in August 1969. The two grounds were part of a high density of breeding prairie chickens at Bogota this spring. Five booming grounds containing from 3 to 54 cocks each and totaling approximately 83 cocks were established in the one-half Section that contains the Yeatter, McGraw, and Marshall Field III sanctuaries (232 acres). The close spacing of the two atypical grounds and the use of small sites for booming may thus be a function of high population density. The situation

remains intriguing, however, because in the vicinity of both grounds an 18-acre site was plowed and 10 acres of a 20-acre redtop meadow were burned for the express purpose of providing suitable sites for booming--but no booming occurred on either site.

6. <u>Rabbit Management</u> G. B. Rose

The energy consumed by cottontail rabbits has been measured, and the energy assimilated has been estimated, from late February through June, as described in MWRL 13(2):4-5. The estimates of energy assimilated are also estimates of energy metabolized, since these are adult rabbits and growth is negligible.

Rabbits maintained in outdoor pens in late February, early April, early May, mid-May, early June, and mid-June consumed averages of 412, 395, 485, 475, 370, and 382 kcal of commercial rabbit chow per day, which, with an assimilation efficiency of 63 percent, represents 260, 249, 305, 299, 233, and 241 kcal of energy assimilated per day. Rabbits kept in outdoor cages consumed averages of 334, 328, 309, 279, 237, and 246 kcal of rabbit chow per day, and assimilated 210, 206, 195, 175, 149, and 155 kcal per day, respectively, for the six time periods mentioned above. The greater amounts of energy assimilated (and hence the greater amounts metabolized) by the penned animals represent their greater activity, compared with that of animals confined in the much smaller cages.

A decreasing trend in energy utilization from late winter to early summer appears to exist for the caged animals, but none is evident for those in the pens.

Higher energy requirements at low winter temperatures than at high summer temperatures may be expected in homoiothermic animals, hence the decreasing trend in energy utilization by the caged animals. The animals in the pens, although requiring less energy for thermoregulation in the summer than in winter, may be more active in the summer, thus obscuring their reduced requirement for thermoregulation.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois July, 1970 Vol. 13, No. 7

1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

Observations of tagged cocks (color coded by age-class) were examined for differences in reproductive success in relation to age. The observation period extended from April 15 to May 15, the peak period of breeding behavior. Since some cocks were not individually identified, repeat observations could not be excluded. Consequently, all observations, including known repeats, were included in the analyses. Data were analyzed for 1962-64, when sex ratios were similar (15-18 cocks per 100 hens).

The average number of associated hens per cock was 1.4 for first-year cocks (119 observations); older cocks (87 observations) averaged 3.2 accompanying hens. Significantly greater numbers of hens were associated with older cocks (X^2 = 78.8, $P<0.01$). Presumably, the greater success of older cocks in attracting hens results from their ability to establish and maintain larger or higher-quality territories.

Although the greater success of older cocks in attracting hens is an interesting aspect of reproductive behavior, any implication for management is not entirely clear at present. Perhaps greater breeding success of older cocks may have some genetic advantage, since older cocks have been exposed to selective pressure for a longer period of time than have young cocks. An earlier opening of the pheasant season might make it possible to selectively harvest juvenile cocks to a greater extent than at present because of differential vulnerability of juveniles to hunting.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

The question of increasing the hazard to motorists, from pheasants, beyond that which already exists is an important consideration in any program to manipulate roadside cover for nesting prairie birds. It is well known that pheasants frequently cross highways (and therefore constitute a traffic hazard), but little is known about the association of highway roadside cover with the incidence of pheasants crossing highways. We do not know what proportion of the pheasants crossing highways are associated with roadside cover, and what proportion are crossing between fields unassociated with roadside cover.

In an attempt to answer this question, Illinois State Police in three districts (5, Joliet; 6, Pontiac; 10, Pesotum) recorded data on pheasants flying across, walking across, or standing on highways, May 8 through June 8. During this 32-day period, a total of 2,724 pheasants were observed crossing or standing on highways (1,320 cocks; 1,172 hens; 232 of unknown sex). The greatest number of birds observed by State Police was in district 10 (1,406), followed by

district 6 (1,076), and district 5 (242). These data are now being prepared for key punching and detailed analysis by computer.

3. Ecology and Management of Squirrels C. M. Nixon

This project will be activated in September 1970.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis, D. R. Vance

We calculated an "importance value" in analyzing vegetation found in quadrats on plots burned in the experimental management zone on the Dale Area. The quadrats were taken in August 1969 on plots burned either in March 1968 or March 1969. The importance value represents the average percentage of total vegetation for a given species times its frequency of occurrence over all quadrats sampled. The importance value may range from 0 to 100, but values >10 indicated dominant plants in most instances.

Goldenrod (Solidago spp.) and lanceleaf ragweed (Ambrosia bidentata) are dominant plants on all burned plots. Common ragweed (Ambrosia artemisiifolia) appears to be most important the first growing season after burning; it becomes less important in the second growing season after burning, as succession advances. Other species showing this trend are partridge-pea (Cassia fasciculata) and wild bean (Strophostyles spp.). Species that become more important in the second growing season after burning are broom-sedge (Andropogon virginicus), fall white aster (Aster pilosus), Korean lespedeza (Lespedeza stipulacea), and panic grass (Panicum huachucae). Of these, only Korean lespedeza is an important quail food. Thus, two growing seasons after burning, important quail-food plants begin to decline as nonfood plants increase in dominance.

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier

The fate of 153 prairie chicken nests from the Bogota Study Area during the 7-year period of 1963-69 was determined by examination of 114 nests by research personnel and by 39 "reliable" reports of nests from local cooperators. Overall hatching success has averaged 49 percent. This level of hatching success is strikingly similar to those reported in the literature for Wisconsin, Missouri, Kansas, Michigan, and for Dr. Ralph Yeatter's 1935-36 work in Illinois. On the sanctuaries exclusively, however, 69 percent of 87 nests have been successful during the same 7-year period.

As of July 20 this summer, 37 prairie chicken nests have been found on the sanctuaries at Bogota. Hatching success for the nests in 1970 has so far averaged 69 percent, the same as the average for 1963-69. As in the past two summers, the major portion of the nesting effort of the Bogota flock is on the sanctuaries, where nesting success is high once again.

6. Rabbit Management G. B. Rose

The energy assimilated by cottontail rabbits in outdoor pens and in outdoor cages was estimated by multiplying the average assimilation efficiency by the kcal of commercial rabbit chow consumed per day (MWRL 13(2):4-5).

Rabbits kept in pens consumed an average of 304 kcal per day for July 7-13, and 302 kcal per day for July 13-19, and hence assimilated an estimated 191 kcal per day for July 7-13, and 191 kcal per day for July 13-19. (All experimental periods began in the afternoon.) Caged rabbits consumed an average of 246 kcal per day for July 7-13 and 202 kcal per day for July 13-19, and assimilated 154 kcal per day and 127 kcal per day, respectively, for the two periods.

These data show a continuation of the decreasing trend in energy utilization by the caged rabbits, which has existed since the study began in February, and an apparent decreasing trend by the penned animals, which began in May. This trend accords with the expected reduction in energy requirements by these animals, which require more energy for thermoregulation at winter temperatures than at summer temperatures.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

NATURAL HISTORY SURVEY
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Urbana, Illinois August, 1970 Vol. 13, No. 8

1. Pheasant Populations and Land Use S. L. Etter, R. E. Greenberg

Standardized counts of pheasant broods, made on the Sibley Study Area during July and August 1970, recorded 42 percent more broods than in 1969. One hundred eighty broods were observed along 640 miles of roadside transect (two 40-mile routes were driven each week), compared with 127 broods in 1969. The average size of broods judged to be completely counted was 5.2 chicks in both 1969 and 1970.

The number of adult hens observed along these same 640 miles increased from 230 in 1969 to 309 in 1970 (34 percent). Twenty-six percent of the adult hens observed in August 1970 were broodless, compared with 28 percent in August 1969.

The above indices suggest a substantial increase in pheasant numbers in 1970, compared with 1969.

2. Manipulation of Pheasant Habitat G. B. Joselyn

Densities of pheasant nests in 1970 on seeded roadside plots (averaging 2.8 nests per acre) represented the highest rate of nest establishment on this type of roadside since 1966, when 2.9 nests per acre were established. Rates of nest establishment on seeded roadside plots have varied from a low of 1.7 nests per acre in 1969 to a high of 3.8 nests per acre in 1964. Nest densities declined each year from 1966 through 1969.

The nest density on managed control roadside plots was 1.5 nests per acre this year, up slightly from 1.3 nests per acre in 1969. Managed control roadsides have varied in nest densities from a low of 1.3 nests per acre in 1969 to a high of 2.8 nests per acre in 1963. Nest densities on managed control roadside plots either decreased or remained unchanged each year from 1963 through 1969.

3. Ecology and Management of Squirrels C. M. Nixon

The first report on this project will appear in the September issue of the Monthly Wildlife Research Letter.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis, D. R. Vance

Counts of whistling bobwhites along standardized routes on the Forbes and Dale areas may be used as indices of fall population densities (MWRL 10(9):2) on the areas. Analysis of 1964-69 data showed significant regressions ($P < .005$) of number of calls per listening stop on fall population densities. Predicted

populations for the fall of 1970, based on these regression formulae, are 21.6 quail per 100 acres on the Forbes Area and 41.7 quail per 100 acres on the Dale Area. These data indicate a 17 percent lower population density for both areas than in 1969.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

During the spring of 1970, approximately 324 people visited the prairie chicken sanctuaries in Jasper County on a reservation basis. In addition, an unknown number of people who made no reservations visited the sanctuaries. The numbers of guided visitors in 1966, 1967, 1968, and 1969 were 56, 84, 159, and 225, respectively. Thirty-three groups and 24 mornings were involved this spring. Groups represented included the following: Newton High School, about 90 individuals; Illinois Audubon Society, 27; Champaign Centennial High School Conservation Club, 26; Champaign County Audubon Society, 26; Indiana University, Bloomington, 18; Prairie Chicken Foundation of Illinois, 15; Eastern Illinois University, 15; Great Lakes Chapter, Sierra Club, 15; Western Illinois University, 14; Southern Illinois University, 13; Olney Central College, 12; Prairie Grouse Committee, 9; University of Illinois, 9; Illinois Natural History Survey, 8; Illinois State University, Normal, 5; Effingham D.A.R., 4; University of Illinois, Extension, 4; Illinois Department of Conservation, 2; University of Sweden, Stockholm, 2; and 10 other ornithologists, sportsmen, and interested individuals. These data attest to the growing interest in the preservation of prairie chickens in Illinois.

Included among the 324 visitors in 1970 were 187 individuals who assisted the research project materially by spending 192 man-mornings in blinds. These observers produced 46 detailed records of booming ground activity, each of which covered at least a 2-hour period on a booming ground.

6. Rabbit Management — G. B. Rose

The energy consumed per day by cottontail rabbits in outdoor pens and in outdoor cages was measured as described in MWRL 13(2):4-5, from mid-February through mid-August, 1970. Food consumed per day by the rabbits in the cages was negatively correlated with air temperature. The relationship is expressed in the equation $\hat{Y} = 98.49 + 0.542X$, when X is the mean air temperature for the experimental period, and Y is the number of grams of rabbit chow consumed per day. However, food consumption by the penned cottontails was not significantly correlated with air temperature for the time period from mid-February through mid-August.

In general, the energy required by homoiothermic animals for thermoregulation decreases as their zone of thermoneutrality (the range of temperatures at which no energy is expended for maintenance of body temperature) is approached, hence the decreasing trend in energy utilization by the caged rabbits. The reason for the failure of the penned animals to reduce energy utilization is not known, but may be a result of increased activity in summer or of changes in endocrine function during the breeding season. Since caged cottontails do not breed, such changes would not influence their energy utilization.

SPECIAL REPORT

Factors Influencing Distribution and Abundance of Pheasants W. L. Anderson

It was previously reported that selected tissues (bone, liver, and muscle) from juvenile hens from Neoga (poor pheasant range) and from Sibley (good range) were being analyzed for sodium, calcium, magnesium, phosphorus, and potassium (MWRL 13(6):1-2). The hens were collected during February 1970. These analyses, which have now been completed, were conducted because earlier work indicated that sodium levels in grit and in pheasants were lower at Neoga than at Sibley.

It was rewarding to learn that, of the five elements included in the analyses, sodium was the only one that exhibited statistically significant differences between birds from the two areas. It was surprising--and perhaps not rewarding--that sodium was more abundant in the Neoga birds than in the Sibley birds. Sodium averaged 5,970 ± 94 and 5,342 ± 105 ppm in bone (difference is significant), 856 ± 16 and 749 ± 41 ppm in liver (difference is significant), and 371 ± 16 and 371 ± 17 ppm in muscle, Neoga birds compared with Sibley birds. These findings suggest that, if a sodium imbalance exists among pheasants at Neoga, the imbalance is not a simple deficiency, as was previously thought (MWRL 13(2):2-3). It is obvious that sodium levels in various components of the environment and in pheasants at Neoga and at Sibley need considerably more investigation.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois September, 1970 Vol. 13, No. 9

NATURAL HISTORY SURVEY
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1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

Use of a 24-acre hayfield in Livingston County by nesting pheasant hens has been studied since 1966. The field was divided into 40 plots, each a little more than ½ acre in size, which were separated from each other by mowed strips 2 yards wide. Late in March and early in April, 1970, we burned 20 of the 40 mowed plots to see how hen pheasants would place their nests in relation to the burned plots. We searched the field thoroughly for pheasant nests in June and again in July, 1970, and found a total of 42 nests.

If hens placed their nests without regard to the fire, we would expect 21 nests in the burned plots and 21 in the unburned plots. We found 15 nests in the burned plots and 27 in the unburned plots. Chi-square analysis of these data indicated that the relationship between numbers of nests established in burned plots and in unburned plots approached statistical significance ($\underline{X}^2 = 3.43$, df = 1, $0.10 < \underline{P} < 0.05$). Hens apparently tended to avoid establishing nests in the burned plots.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

In the last Monthly Wildlife Research Letter (13(8):1), it was reported that densities of pheasant nests this year (1970) on seeded roadside plots (2.8 nests per acre) represented the highest rate of nest establishment on this type of plot since 1966, when 2.9 nests per acre were established. The nest density on managed control roadside plots this year was 1.5 nests per acre, up slightly from 1.3 nests per acre in 1969.

On seeded plots in 1970, successful nest production (0.8 nest per acre) was up slightly from production in 1969 (0.7 nest per acre); production on managed control plots (0.5 nest per acre) was down somewhat from that in 1969 (0.6 nest per acre). Production on seeded plots has varied over 8 years (1963-1970) from a high of 1.1 successful nests per acre in 1963 to a low of 0.5 successful nest per acre in 1967. On managed control plots, production has ranged between 0.3 nest per acre in 1964 and 0.6 nest per acre in 1969. Over the 8 years, 114 nests have hatched on seeded plots (0.8 nest per acre), compared with 70 nests on managed control plots (0.5 nest per acre).

3. Ecology and Management of Squirrels

C. M. Nixon

Squirrels are the second most important game animals in Illinois in terms of hunter kill, with between 2 and 3 million squirrels shot each year. Yet there has not been a long-term squirrel study in Illinois since Brown and Yeager's initial studies in the 1940's.

Initial efforts in this study will involve selection of study areas representative of both gray and fox squirrel (Sciurus carolinensis and S. niger) habitat in northern, central, and southern Illinois, a literature review of squirrel ecology, and formulation of study plans.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, D. R. Vance

Ideally, prescribed burning of habitat for quail management should reduce all dead vegetation to ash, and the resulting vegetative regrowth should be an open stand, primarily an admixture of annual grasses and weeds. Many environmental factors influence the vegetative response to burning; among these are the vegetative history, the size of the unit burned, and the weather conditions at the time of, and after, burning.

For economic reasons, we enlarged the size and reduced the number of prescribed burn plots on the Dale Area in 1970 (MWRL 13(4):2). We did not, however, achieve the desired results with the burns in 1970, unlike our success in previous years. Because the plots were larger, it was difficult to run fire throughout all the plots, and much dead vegetation remained. With smaller plots, it was possible to run fire through an entire plot without much difficulty.

The incomplete burns in 1970, plus the above-normal rainfall during April, May, and June and the resulting luxuriant vegetative growth, was reflected in the amount of bare ground recorded in quadrats taken in late July. An average of 14.2 percent bare ground was recorded in 1970, whereas an average of 25.5 percent bare ground was recorded in 1969 on plots burned that year.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

A total of 61 prairie chicken nests were found on the sanctuaries at Bogota during the summer of 1970. Thirty-nine of the 61 nests successfully hatched; 21 were abandoned and/or destroyed by predators; and the fate of 1 nest remained unknown. The success level of 65 percent hatched nests was slightly under the mean of 69 percent for the 7-year period of 1963-69 (MWRL 13(7):2). Two nests (in addition to the 61 above) were reportedly destroyed by plowing on private farmland.

The overall density of prairie chicken nests in 1970 on sanctuaries (averaging 12.4 acres per nest) represented the third highest rate of nest establishment since 1963. The sanctuary acreage searched, 1963 through 1970, was 62, 97, 152, 152, 214, 290, 347, and 566, respectively; the respective number of acres searched per nest found was 6.9, 5.7, 38.0, 30.4, 21.4, 16.1, 12.4, and 9.3. Thus, it is evident that current densities of nests on the comparatively large sanctuary system are approaching those recorded in 1963-64, when a limited sanctuary acreage was available for the Bogota flock. A 13-acre field on the west end of the 77-acre Yeatter Sanctuary comtained 7 nests (1.9 acres per nest) this summer and therefore exceeded the previous record density of 8 nests in a 19-acre (2.4 acres per nest) field on the same sanctuary in 1964.

6. Rabbit Management

G. B. Rose

Bailey (1968, Job Completion Rept., INHS) suggested that the capacity of cottontails to digest starches may change as the rabbits mature. If it is true that the efficiency of starch digestion improves as the animals develop, and if the digestion of the other components of the diet does not become less efficient in the meantime, then the assimilation efficiency shown by cottontails maintained on a diet of the same food should increase as the rabbits mature.

Assimilation efficiencies of 19 cottontails being fed a diet of commercial rabbit chow were calculated for rabbits ranging in size from 337 grams (about 6 weeks old) to 1,160 grams (adults). There was no significant correlation between body weight and assimilation efficiency ($\underline{R} = +0.192$).

Therefore, the failure of the assimilation efficiencies to increase provides no evidence of increasing efficiency of starch digestion with maturation in cottontails, 6 weeks of age and older. It remains possible, however, that cottontails younger than 6 weeks may show a change in efficiency of starch digestion.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois October, 1970 Vol. 13, No. 10

1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

During the summers of 1969 and 1970, 30 unmarked hen pheasants were captured on their nests while they were incubating. Three additional incubating hens were examined after being killed by hay mowers. Proximal primary wing feathers removed from these 33 hens were measured and age-classes were assigned according to criteria established on the basis of measurements of the proximal primaries of hens captured during the winter of 1970 (MWRL 13(3):1). From 1963 through 1969, 22 tagged hens of known ages were observed on nests.

Incubated clutches from nests established by 25 first-year hens varied in size from 6 to 19 eggs, with a mean and standard deviation of 10.6 ± 3.5 eggs. Incubated clutches of 30 older hens varied in size from 6 to 21 eggs, with a mean and standard deviation of 11.1 ± 3.0 eggs. These data indicate that clutch size is highly variable for both first-year and older hens and that extremely large sample sizes would be necessary to determine whether the observed difference in clutch sizes between age-classes is significant.

When only those nests established during the period April 30 to May 27 were compared, the mean clutch sizes of 16 first-year hens and of 15 older hens were nearly equal (11.1 and 11.2 eggs, respectively). Thus, the slightly larger mean clutch size of older hens, compared with that of first-year hens, apparently resulted from a greater proportion of large clutches laid by older hens early in the nesting season. It appears from these data that any differences in reproductive performance between first-year and older nesting hens result from differences in the timing and persistence of the nesting effort rather than from differences in clutch size.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

Because unmanaged control plots represent "typical" roadsides on the study area (in that their mowing is not controlled), differences in pheasant nest densities between this type of roadside and seeded plots are considered the best indicators of the response of pheasants to the seeding of roadsides.

For the 8 years 1963-1970, pheasant nest density on seeded plots (2.6 nests per acre) was about double that on all (mowed and unmowed) unmanaged control plots (1.2 nests per acre). Nest density on seeded plots was about three times that on mowed, unmanaged control plots (0.8 nest per acre), but was only about one-fourth greater than the density on unmanaged control roadsides that were unmowed (2.0 nests per acre), thus indicating that merely leaving roadsides unmowed could result in meaningful benefits to nesting pheasants.

3. Ecology and Management of Squirrels — C. M. Nixon

A sample of milk was collected from each of eight female gray squirrels (*Sciurus carolinensis*) and the samples were pooled for analysis. The pooled sample, about 2 cc, was composed of 9.0 percent protein, 12.1 percent fat, 3.0 percent lactose, 1.3 percent ash, 0.36 percent calcium, and 0.45 percent phosphorus. This analysis is virtually identical in content to that reported by the International Zoo Yearbook, 1962, for a single specimen. Both samples indicate that squirrel milk is considerably higher in protein and in fat than is whole milk from cows. Cow's milk, if used in the formulation of a substitute milk for preweaned gray squirrels, should be enriched with supplements.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, D. R. Vance

The mean weights recorded for subadult cock quail captured on both the Dale and Forbes areas by cock-and-hen traps were heavier during the summer of 1970 than in the summer of 1969. The trapping period extended from mid-May to mid-July both years. The mean weight of 136 subadult cocks on the Forbes Area in 1969 was 164.4 $\pm$ 1.0 grams. In 1970 the mean weight of 63 subadult cocks on Forbes was 168.3 $\pm$ 0.7 grams. This difference in mean weights was statistically significant ($P < 0.05$).

On the Dale Area, the mean weight of 91 subadult cocks in 1969 was 161.5 $\pm$ 0.8 grams; in 1970, the mean weight of 75 subadult cocks was 164.4 $\pm$ 0.8 grams. However, this difference in mean weights was not statistically significant ($P > 0.05$). The data tentatively suggest a correlation between population density during late winter and the weight of subadult cocks during summer (the lower the prebreeding density, the higher the mean weight of subadult cocks).

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

During the 8-year period of 1963-70, the sizes of 88 incubated clutches of prairie chicken eggs at Bogota ranged from 6 to 17 eggs. The mean number of eggs per incubated clutch ranged from 10.7 in 1966 to 13.0 in 1970 and averaged 12.2 for the 8-year period. The mean number of fertile eggs per incubated clutch (77 clutches) ranged from 9.8 in 1966 to 12.3 in 1970 and averaged 11.7 for the past 8 years. The mean number of hatched eggs per successful nest (79 clutches) ranged from 9.8 in 1964 to 11.6 in 1970 and averaged 11.3 for the 8-year period.

Although the means for clutch size, fertile eggs per clutch, and hatched eggs per clutch were higher in 1970 than in any of the preceding 7 years, the means for 1970 were not significantly different from the means for the 1963-69 period when tested with Chi-square. A minimum of 428 chicks were hatched from 39 of the 61 nests found on the sanctuaries at Bogota in 1970.

6. Rabbit Management — G. B. Rose

The annual fall censusing of cottontail rabbits on the 100-acre (40-hectare) 4-H Area at Robert Allerton Park is being continued this fall, the 15th successive

year. Ninety-three rabbits were trapped and ear-tagged during a 10-day period at the beginning of October. Several population estimates were calculated from the capture and recapture data. The Schnabel (short form) estimate is 120 animals, the geometric maximum likelihood estimate (MLE-G) is 228, and the maximum likelihood estimate from a regression of the logarithm of the number of individuals in a frequency class on frequency of capture (MLE-R) is 193. The MLE-R is regarded as the best method of estimation. The estimate of 193 rabbits is considerably less than the estimate of 279 and 278 for October and November 1969, but is similar to the estimates of 170 and 176 for October and November 1967, and to the estimates of 177 and 211 for October and November 1968. The estimate in 1970 represents a continuation of the relatively high fall densities present on the study area since 1966, which followed low densities from 1962 through 1965, preceded by high densities from 1956 through 1961.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

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Urbana, Illinois | November, 1970 | Vol. 13, No. 11

1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

During the summers of 1969 and 1970, 30 unmarked hen pheasants were captured on their nests while they were incubating. Whenever possible, the stage of incubation was determined at the time of the initial discovery of a nest and netting attempts were delayed until the last half of the incubation period. Proximal primary wing feathers removed from the 30 captured hens were subsequently measured, and age-classes were assigned on the basis of measurements of the proximal primaries of hens captured during the winter of 1970 (MWRL 13(3):1). After capture, the hens were dizzied with their heads tucked under their wings and were then placed adjacent to the nest sites.

Six of the nests incubated by these hens were terminated by predation prior to return visits. Of the remaining 24 nests, 9 were incubated by first-year hens and 15 were incubated by older hens. The mean incubation stage at the time of capture of the hens was 16 days for both age-classes. Six of the 9 nests incubated by first-year hens were abandoned after capture of the hens, compared with 3 of 15 nests incubated by older hens. Chi-square analysis of these data revealed that these differences in rates of abandonment approached statistical significance ($\underline{P} < .10$) despite the small size of the sample.

Although it is recognized that the netting of incubating hens is a highly artificial form of disturbance, these data suggest that the broodiness of older hens is considerably greater than that of first-year hens. Although larger sample sizes are desirable to confirm the above findings, these observations suggest significant differences in endocrine function between first-year and older hens. This hypothesis is supported by earlier findings--based on observations of known-age, tagged hens with broods--which suggested that the nesting effort of older hens was more prolonged than that of first-year hens (MWRL 12(6): 1).

2. Manipulation of Pheasant Habitat

G. B. Joselyn

For large-scale roadside-seeding programs to be successful, cooperating farm operators must refrain from mowing their roadsides until about July 31. Widespread mowing much before this date would greatly diminish the value of seeded roadsides as nesting cover for pheasants. Whether most farm operators on the FCMU would delay the mowing of their roadsides (as agreed) until the date specified was a primary aspect of the program on the FCMU. Frequent mowing of roadsides by farmers, beginning in June, is typical throughout much of central Illinois; in this area, it is uncommon to find a roadside that is unmowed on

July 31. Thus, for farmers on the FCMU to refrain from mowing until the date requested by Department biologists constitutes a departure from past practices.

During the summer of 1967, before any of the farmers on the FCMU had been contacted, checks were made on the progress of mowing operations on the study area. Nearly 60 percent of the roadsides had been mowed by June 15 and nearly 90 percent by July 15.

Data for 1968 could not be used for comparison, as cooperating farmers were requested to mow their roadsides several times that summer to facilitate the operation of the seeder; in 1969, cooperators were asked to mow their roadsides at their discretion--when the roadsides became unsightly. It is apparent from checks carried out in 1970 that cooperating farmers on the FCMU generally adhered to the delayed-mowing agreement. Less than 10 percent of the roadsides of cooperating farmers had been mowed by July 31, which contrasts with 97 percent of the roadsides mowed by this date in 1967. By August 15, 1970, about 60 percent of the roadsides had been mowed, compared with nearly 100 percent on the same date in 1967. To verify the delay of mowing on the FCMU, checks were made during 1970 on the progress of mowing on the control area. On that area, almost 90 percent of the roadsides had been mowed by July 1.

3. Ecology and Management of Squirrels — C. M. Nixon

Corpora lutea and fetus counts from 33 pregnant gray squirrels provided an estimate of prenatal mortality for this species. There were 102 ova released by these females and 95 ova were successfully implanted. This represents a 6.9 percent loss of ova occurring between the time of ovulation and cornua implantation. Mortality of embryos/fetuses was low; only two dead fetuses were found in the total sample of 95 fetuses, or a 2.1 percent loss for the 43- to 45-day gestation period. Thus, the total prenatal mortality for this sample was about 9.0 percent.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, D. R. Vance

Prehunt censuses of quail were conducted on the Dale and Forbes areas in late October and early November, 1970. Results of these censuses revealed population declines on both areas when compared with populations in 1969.

The fall population on Forbes in 1970 was 23.3 quail per 100 acres, a decline of 10.7 percent from the 1969 level of 26.1 quail per 100 acres. Quail density in the experimental management zone on Forbes was 53.2 birds per 100 acres, a decrease of 18 percent from that in 1969. Another 250-acre zone on Forbes, managed by sharecropping since 1968 by the Division of Wildlife Resources, had a slight increase in quail density, from 52.0 quail per 100 acres in 1969 to 54.8 quail per 100 acres in 1970.

A population density of 37.1 quail per 100 acres was recorded this fall (1970) on the Dale Area, a decline of 0.8 percent from that recorded in 1969. The population on the zone managed exclusively by prescribed burning declined 52.8 percent from the 1969 level (43.2 quail per 100 acres) to the 1970 level (20.4 quail per 100 acres). In contrast, the population on the remainder of the Dale Area increased 18.0 percent.

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier

The means for clutch size, fertile eggs per clutch, and hatched eggs per clutch of prairie chicken eggs were higher in 1970 than in any of the preceding 7 years on the Bogota Study Area (MWRL 13(10):2). However, the mean hatchability of 89.5 percent (349 of 390 eggs hatched) for 30 incubated clutches in 1970 was the lowest for the 8-year period.

A correlation analysis between percent hatchability and clutch size showed an inverse relationship ($r = -0.933$, $P < 0.01$). When the mean clutch size was relatively high, the number of prairie chicken eggs that hatched tended to be correspondingly lower. There was no significant correlation between percent fertility and clutch size ($r = 0.029$). Thus, decreasing hatching efficiency with increasing clutch size occurs independently of the level of fertility. These data suggest the possibility that clutch size in the prairie chicken is limited by the number of eggs that a hen can cover and successfully incubate.

6. Rabbit Management G. B. Rose

The annual fall censusing of cottontail rabbits on the 100-acre (40-hectare) 4-H Area at Robert Allerton Park is being continued this fall, the 15th successive year. During the 10-day November trapping period, 104 cottontails were trapped and ear-tagged, 10 more than the 94 captured during the October trapping period. Estimates of the number of rabbits in the population, calculated from the trapping data, were 142 by the Schnabel method, 284 from the geometric maximum likelihood estimate (MLE-G), and 307 using the maximum likelihood estimate from a regression of the logarithm of the number of individuals in a frequency class on frequency of capture (MLE-R). The MLE-R is considered the best method of estimation. All three estimates are biased because, during the trapping, predators removed approximately 20 rabbits from the traps. These losses not only prevented the recording of some captures (both new captures and recaptures) but also precluded the possible recapture of the same 20 cottontails, thus reducing the proportion of recaptures in the total and thereby increasing the size of all three estimates (Schnabel, MLE-G, and MLE-R). Estimates adjusted for the trap losses were 137 (Schnabel estimate, 5 less than the unadjusted estimate) and 265 (MLE-G, 19 less than the unadjusted estimate). An adjusted MLE-R estimate was not possible. Thus, our population estimates, even when adjusted, show a definite increase in numbers of cottontails on the study area, which must be attributed to immigration. The data do not show any significant losses, from mortality or emigration, in the animals trapped in October. Consequently, the increase in population represents a movement of animals from outside the area into it. This movement may be a shift toward greater use of those portions of home ranges within the 4-H Area and less use of those portions in the adjoining cropland. This same pattern of increase in the cottontail population from October to November existed in 1968 but not in 1967 or 1969.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | December, 1970 | Vol. 13, No. 12

1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

Beginning in the fall of 1968, half of the juvenile cock pheasants captured during the fall trapping period were marked with back tags and bands and half were marked with bands only. Tags and bands, and bands only, were put on alternately, so that the effects of differences in locations and in dates of capture were minimized. Adult cocks were excluded from the samples because of the small numbers captured and the possibility of differences in recovery rates related to age.

During the hunting season of 1968, 13 cocks with tags and bands and 12 cocks with bands only were shot and were reported to project personnel. During the hunting season of 1969, three additional cocks with tags and bands and four cocks with bands only, from the sample trapped in 1968, were reported shot. Twelve cocks with tags and bands and 13 cocks with bands only, from the sample trapped in 1969, were reported shot during the hunting season of 1969. To date (December 20, 1970), one additional cock with a tag and band and one cock with a band only, from the sample trapped in 1969, have been reported shot during the current hunting season. Only one cock with a tag and band and two cocks with bands only, from the small sample trapped in 1970, have been reported shot thus far.

Although the numbers of marked cocks shot by hunters are small, these findings suggest that the survival rate of tagged and banded juvenile cock pheasants is nearly equal to that of juvenile cocks marked only with bands. Because of the short period of time between marking and recovery (first-year recoveries) during the hunting season of 1968, large numbers of second-year recoveries are desirable. At present population levels, however, too few pheasants can be captured to accumulate significant numbers of second-year recoveries except on a long-term basis.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

For the 8 years 1963-70, pheasant nest density on seeded roadsides (2.6 nests per acre) was more than double the density of nests on all (mowed and unmowed) unmanaged control roadsides (1.2 nests per acre), which are considered "typical" unseeded roadsides on the study area.

Density of successful (hatched) nests on seeded plots for the 8 years (0.8 successful nest per acre) was slightly more than double the density of successful nests on all unmanaged control plots (0.3 successful nest per acre). On mowed,

unmanaged control plots, for the 8 years, density of successful nests was 0.2 per acre, whereas on unmowed, unmanaged control plots, the success rate was 0.6 nest per acre. The density of successful nests on seeded plots ranged from 0.5 to 1.1 during the 8 years. The density on mowed, unmanaged control plots varied between 0.0 and 0.4 successful nest per acre; unmowed, unmanaged control plots had from 0.4 to 1.1 successful nests per acre.

3. Ecology and Management of Squirrels — C. M. Nixon

There is a lack of information concerning the extent of breeding by each age-class of female gray squirrels. Most populations are diestrous, with breeding peaks in January-February and July-August each year. During each of these breeding periods, the female segment of the squirrel population consists of adult females, yearlings (10-12 months old), and subadults (<5 months old). Past studies have often assumed that virtually all the adult (<18 months) females breed during each breeding period and that subadults usually experience their first estrus when 10-12 months old. Information collected between 1968 and 1970 casts doubt on the validity of these assumptions. Placental scar counts from 144 adult females showed that 96 (66.7 percent) bred during the winter-spring breeding period but only 94 (65 percent) bred during the summer-fall breeding period. Only 22 (62.8 percent) of 35 known yearlings bred when between 10 and 13 months old. Only one of these 35 females was known to have bred before she was 10 months old. This squirrel, born in July 1969, was actively lactating when recaptured in April 1970. Thus, during each breeding period, two-thirds of the adult females, 60 percent of the yearling females, and less than 5 percent of the subadult females may be expected to breed and rear young.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, D. R. Vance

Some insight into the mobility of cock quail during the summer was obtained from birds recaptured in cock-and-hen traps on the Bogota Area in 1963 and on the Alma Area in 1964 and 1965. These movements were considered extreme because the traps were distributed over extensive areas, and a trap was never closer than 0.25 mile to its nearest neighbor.

Only a small proportion of the total captures were recaptured at locations other than the original trap sites. At Bogota, 19 percent of the total number of individuals captured were recaptured at other trap sites; at Alma, 12 percent of the individuals captured in 1964 and 1965 were retaken at other than the original trap sites.

There was no apparent overall pattern regarding distances moved. Movements ranged from 0.25 to 2.03 miles at Bogota: there were 13 records of movements within the 0.25- to 0.5-mile range (nine individuals), 2 records of movements within the 0.5- to 1-mile range (two individuals), and 7 records of distances moved that were >1 mile (four individuals).

At Alma, movements ranged from 0.25 to 1.48 miles. Only six movements were recorded at Alma in 1964: two individuals moved 0.25 to 0.5 mile, and four

individuals moved 0.5 to 1 mile. In 1965, only one movement within the 0.25- to 0.5-mile range was recorded (one individual); three movements within the 0.5- to 1-mile range were recorded (three individuals); and four movements were >1 mile (two individuals). These data reflect the apparent nomadism among a small percentage of the cock population during the summer.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier

On the Bogota Study Area during the period of 1963-70, distances between 174 prairie chicken nests and the estimated centers of the nearest booming grounds have ranged from 72 yards to 1,700 yards, with respective mean, mode, and median distances of 364 ± 253 (SD) yards, about 240 yards, and about 300 yards. Thus, few nests occur within 100 yards of, or farther than 600 yards from, centers of booming grounds.

In 1968 and 1969, evidence indicating the existence of a preferred zone for nesting was obtained in situations involving booming grounds surrounded with nesting cover. Nests were found in radial patterns encircling several booming grounds. Although no distinct spokes-in-a-wheel patterns were found at Bogota in 1970, as were found in 1968 and 1969, the most frequently occurring distance of about 240 yards became even more clearly evident than formerly. In contrast to average distances exceeding 500 yards between booming grounds and prairie chicken nests in 1963-64, when the population was declining, the average distance has progressively decreased (275 yards in 1970) as the Bogota flock increased. This gradual change in nest dispersion relative to the booming grounds has occurred because of (1) the provision of suitable sites for booming (and the establishment of nesting cover) on the sanctuaries and (2) the apparently greater advantages accruing to reproduction from the presence of nesting cover close to and surrounding booming grounds.

6. Rabbit Management — G. B. Rose

Estimates of population density of cottontail rabbits on the 100-acre (40-hectare) 4-H Camp Area at Robert Allerton Park, based on livetrapping conducted during the first 10 days of December 1970, were 92 by the Schnabel method, 174 by the geometric maximum likelihood estimate (MLE-G), and 193 by the maximum likelihood estimate from a regression of the logarithm of the number of individuals in a frequency class on frequency of capture (MLE-R). The MLE-R is considered the best method of estimation.

The fall population estimates (MLE-R) of 192 for October, 307 for November, and 193 for December, 1970, show a continuation of the relatively high densities on the study area that have existed since 1966, after several years of low fall densities (1962 through 1965) and a period of high fall densities (1956 through 1961).

The data did not show any mortality of the October-captured rabbits between the October and November trapping periods. This is consistent with the corresponding data from 1969, which did not show any mortality for the same period, and from 1968, which showed a mortality of 4 percent. The December data, however, indicated a 31 percent mortality for the November-captured animals between the November and December trapping periods. The corresponding mortality in 1969 was 54 percent. Thus, the same pattern of low mortality in October and high mortality in November continued this year.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois   January, 1971   Vol. 14, No. 1

1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

Each summer the land use on the Sibley Study Area has been recorded on aerial photographs. Until this year (1970), however, calculations of the percentages of land in various cover types have been projected from detailed cover maps for 100, 10-acre plots. Recently, the acreages of all cover types except row crops (corn and soybeans) were calculated from aerial photographs for the years 1962-70.

These data revealed that the percentages of the study area in small grains (oats and wheat) for the years 1962-70, respectively, were 14.9, 13.8, 8.4, 6.4, 4.5, 4.0, 6.1, 8.0, and 4.4. Percentages of the study area in hay and hay pastures during the same period were 12.0, 11.5, 7.0, 5.3, 4.0, 3.6, 3.1, 3.3, and 3.2.

Although the percentages of cover types projected from the 100, 10-acre plots were indicative of the trend toward fewer forage crops, there were notable discrepancies in individual years. Thus, the considerable effort required to calculate all of the acreages of cover types on the entire study area appears to be worthwhile in providing accurate acreages for comparison with various indices of pheasant numbers.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

Data collected from the Sibley Study Area between 1963 and 1970 show that on a per-acre basis, managed seeded roadsides produced about twice the number of successful pheasant nests as unmanaged roadsides. It is therefore reasonable to infer that seedings over a large area could also nearly double pheasant production on roadsides. However, the question of whether seedings over a sizable area would have sufficient impact on the pheasant population to justify their cost remains unanswered. In evaluating the potential of managed seeded roadsides as a management tool, the question is to what extent they could be expected to supplement other production--not whether they could by themselves produce enough birds to insure a huntable population.

At the beginning of this research in 1962, 9.3 percent of the land on the Sibley Study Area was in hay; by 1970 this percentage had dwindled to about 2.6, with indications of further decreases in the future. Thus, it is possible that roadsides, only 1.3 percent of the study area, will constitute the largest segment of potential nesting cover for pheasants.

In 1970, the 149.2 acres of managed seeded roadsides increased the amount of land in hay on the Ford County Management Unit (FCMU) from 402 to 551.2 acres, an increase of 37.1 percent. (At the same time, however, the amount of unseeded roadside cover on the area was reduced by over 90 percent.) If the proportion of the total land area in hay continues to decline, the contribution of the managed seeded roadsides to the total acreage in hay will increase. If, eventually, the acreage in hay on farms makes up only one percent of the land area on the FCMU (102 acres), the 149.2 acres of seeded roadsides will increase the total hay acreage by over 146 percent. Admittedly, increasing 402 acres of hay by 37 percent, or 102 acres by 146 percent, provides only a small amount of hay for an area of this size. Nevertheless, under such circumstances, the contribution of seeded roadsides to the nesting-cover complex could be substantial. Had 90 percent of the roadside acreage on the Sibley Study Area been seeded in 1970, the amount of hay on that 36-square-mile area would have increased from 610 to 923 acres, or 51 percent.

3. Ecology and Management of Squirrels — C. M. Nixon

Female gray squirrels implant fewer fertilized ova during their first estrus than during subsequent breeding periods. Placental scar counts from 46 yearling females showed a mean and standard error of 2.54 $\pm$ 0.11 scars. Similar counts for single litters from 98 adult females provided a mean and standard error of 3.43 $\pm$ 0.09 scars. This difference is statistically significant ($P < 0.01$).

The reduced implantation in yearling breeders can occur as a result of either a lower rate of ova release or a higher rate of ova mortality between ovulation and implantation, compared with rates for older females. Data tending to support either of these assumptions are lacking for the gray squirrel, but data collected from other species of rodents tend to support the assumption of a lower rate of ovulation for yearling female gray squirrels.

The maturation and release of ova in mammals is controlled by the pituitary, through release of the follicle-stimulating hormone (FSH). At least in the domestic rabbit, pituitary weight and the amount of FSH released, vary directly with body weight. If such a relationship occurs in the gray squirrel, yearling females, which average 1 to 3 ounces lighter in body weight than adult females, may produce lesser amounts of FSH than do the adults, thus resulting in fewer mature ova during their first estrus.

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis,
D. R. Vance

Food items in crops from quail harvested on the Forbes Area in 1969 were identified and ranked by percent occurrence and by total volume (cc) for each management zone. All three zones were subject to some sharecropping, with Zone 1 being the most intensively farmed (41 percent cropland). Zone 2 contained about 35 percent cropland. Approximately 15 percent of the open land in Zone 3 was farmed. In addition, food patches were established on Zones 2 and 3.

Crop contents of the harvested birds reflected availability of food items. The three most frequently occurring food items in crops from birds harvested on Zone 1 were Korean lespedeza (*Lespedeza stipulacea*), soybeans (*Glycine max*), and corn (*Zea mays*). The three most important food items by volume were again soybeans, corn, and Korean lespedeza. Korean lespedeza, beggar-ticks (*Bidens* spp.), and foxtail (*Setaria* spp.) were the most frequently occurring food items in crops from birds harvested on Zone 2. Korean lespedeza, wheat (*Triticum aestivum*), and foxtail were the most important food items by volume. The most frequently occurring food items in crops from birds harvested on Zone 3 were Korean lespedeza, corn, and common ragweed (*Ambrosia artemisiifolia*). The most important food items by volume were wheat, corn, and Korean lespedeza.

All important food items were seeds of agricultural crops or seeds of plants associated with early stages of secondary succession. Successful management depends largely upon making such food items readily available to quail.

5. Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier

The changing status of the prairie chicken population on the Bogota Study Area during the past 8 years may be divided into three phases. During the 2 years, 1963-64, the population was decreasing; during the 3 years, 1965-67, the population was relatively stable; and during the past 3 years, 1968-70, the population level has shown substantial gains.

When the fate of 216 prairie chicken nests (found by searches on sanctuaries and private land, and noted according to reliable reports by local residents) were analyzed with respect to the above phases, three definite trends were evident. First, hatching success progressively increased from 36.2 to 47.5 to 60.2 percent for the decreasing, relatively stable, and increasing periods, respectively. Secondly, the percentage of nests destroyed by plowing and hay mowing decreased from 51.7 to 30.0 to 9.3 percent for the three periods, respectively. Thirdly, the percentage of nests destroyed by predators, abandoned, or both, increased from 12.1

to 22.5 to 30.5 percent for the 1963-64, 1965-67, and 1968-70 periods, respectively.

Thus, the increased level of hatching success, coupled with the increasing proportion of hens at Bogota that are nesting on the sanctuaries, where hatching success is particularly high (67 percent, 8-year mean), has played the major role in the recent encouraging increases in the population level. The increasing level of nest predation indicates that nature's culling agents now have a greater chance at nests that used to fall victim to plows and hay mowers.

6. Rabbit Management

G. B. Rose

The energy consumed per day by cottontail rabbits in outdoor pens and in outdoor cages was measured as described in MWRL 13(2):4-5, from February through December 1970. Food consumed per day by the rabbits was negatively correlated with air temperature, for both the rabbits in the pens and the rabbits in the cages. The relationship for the caged rabbits was expressed by the equation $\hat{Y}=90.8-0.42X$, and for the penned rabbits by the equation $\hat{Y}=119.1-0.40X$, when X is the mean air temperature for the experimental period, and Y is the number of grams of rabbit chow consumed per rabbit per day.

The inverse relationship between energy utilization by the rabbits and air temperature probably results from the decreasing requirements of energy for thermoregulation by homoiothermic animals as the zone of thermoneutrality (the range of temperatures at which no energy is expended for maintenance of body temperature) is approached.

The greater energy utilization by the rabbits in the pens than by the caged rabbits may reflect the greater activity by the penned rabbits than by the more confined rabbits in the cages.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | February, 1971 | Vol. 14, No. 2

1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

During the 5-year period 1962-66, the amount of hay and hay pasture on the Sibley Study Area decreased from 2,790 acres to 929 acres (67 percent). Small grains (oats, wheat, and rye) decreased from 3,457 acres in 1962 to 1,032 acres in 1966 (70 percent). Twenty-one percent of the fencerows present in 1962 had been removed by 1966, as had 18 percent of the grass waterways. Fourteen percent of the permanent pasture present in 1962 was under cultivation by 1966, but because roadsides, railroad rights-of-way, and drainage ditches were included in this category, total permanent cover decreased by only 5 percent (1,474 acres to 1,394 acres).

Estimates of the late-summer pheasant populations in 1962 and 1966, based on nest data and brood observations, were 318 and 81 pheasants per square mile, respectively. These data indicate a decrease of 75 percent in pheasant numbers concomitant with the cover changes enumerated above. Inasmuch as estimates of the late-summer pheasant populations during the period 1967-70 have remained below 100 birds per square mile, there is little doubt that the major portion of the decline in pheasant numbers is attributable to a drastic reduction in the carrying capacity of the area, resulting from land-use changes. Thus there is little reason to believe that pheasants will regain more than a fraction of their former abundance without a major reversal in farming practices.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

In the spring of 1968, the Illinois Division of Highways, the Natural History Survey, and the Department of Conservation undertook a cooperative project for experimental management of roadside cover along Highway 47 in Ford and Livingston counties (MWRL 12(12):1-2). Three, 1-mile segments, between Gibson City and Strawn, were seeded on both sides with a combination of smooth brome (*Bromus inermis*) and alfalfa (*Medicago sativa*) from the ditch to the fence and left unmowed. Starting in 1969, the highway was driven at periodic intervals during April, May, and June in an attempt to detect any differences in the frequency of pheasant roadkills adjacent to the unmowed segments as compared with nearby control miles where normal mowing practices were carried out.

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

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population on Forbes in 1971 was lower than the long-term mean estimate of the posthunt population (7.6 quail per 100 acres), and also represented a decline of 74 percent from the prehunt population level in 1970.

On Dale, the posthunt estimate for 1971 was slightly higher than the long-term mean estimate (11.4 quail per 100 acres) for this period. The posthunt estimate in 1971 represented a decline of 61 percent from the prehunt population of 1970. However, the posthunt population on Dale in 1971 was 60 percent greater than the posthunt population on that area in 1970.

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier

Each year since 1963, the acreages of potential nesting cover for prairie chickens have been recorded on the 16-square-mile Bogota Study Area. The total acreage declined from 837 acres in 1963 to a low of 376 acres in 1966. In 1963, sanctuary grassland amounted to only 5 percent of the total; undisturbed fields of legumes (leased by the Illinois Department of Conservation) comprised 221 acres or 26 percent of the total, and grassland on private farmland comprised the remaining 561 acres or 69 percent. Since 1966 the total acreage of potential nesting cover has steadily increased to 770 acres in 1970, 71 percent of which was due to the establishment of nesting sanctuaries.

When the numbers of prairie chicken cocks censused on booming grounds each spring were tested for correlation with the total acreages of grass and leguminous cover available for nesting each preceding spring, a nonsignificant correlation was revealed ($r = 0.636$). However, when only undisturbed fields of grass, grass seed meadows, grass hay meadows, or lightly grazed grass pastures were analyzed with respect to the numbers of prairie chicken cocks, a significant correlation did result ($r = 0.758$, $P < 0.05$). It is probable that an even better correlation would result if only good nesting cover were measured. Use by prairie chickens of otherwise attractive cover is often precluded by such factors as poor drainage, close proximity to woodland, low fertility, or excessive grazing.

In 1963, the 837 acres of available nesting cover produced a population containing 65 cocks the following spring. By contrast, in 1970 the 770 acres of available nesting cover appear to have supported a population that will contain at least 150 cocks (preliminary estimate based on winter counts) in the spring of 1971. It is becoming clear that the present sanctuary grasslands are capable of producing a much higher population level than those that occurred on a similar acreage of private farmland.

6. Rabbit Management G. B. Rose

Of 1,469 rabbits captured on the 100-acre 4-H Area at Robert Allerton Park from 1960 through 1970, 122 were recaptured the first year after initial capture, 28 a second year after initial capture, 6

a third year after the first capture, and 3 a fourth year after the original capture. From these data a life table was constructed, which shows mortality rates of 0.82 for the first to second year of recapture, and 0.77 for the second to third year of recapture, or an overall average mortality rate of 0.80.

In a previous study, a survivorship curve was calculated based on weights of eye lenses of cottontail rabbits collected in Illinois. An average monthly mortality rate of 12.7 percent was computed, which represents an annual mortality rate of 80.4 percent. Thus, the estimated annual mortality rate in the earlier study, which applies to a somewhat younger group of rabbits (from 4 to 29 months) than those treated in this study, is essentially the same as the mortality rates estimated here (for rabbits 15 to 39 months of age--the youngest group--with some older than 51 months).

In another, and later, study, it was estimated that the expected proportion of juveniles (age determined by the eye-lens or epiphyseal-closure techniques) in cottontail populations in the Midwest averaged 0.83. Accordingly, the expected year-to-year mortality rate for juveniles would be 83 percent. This mortality rate for animals in the first year of life is little different from the mortality rates of adults, as determined from the trapping data.

In the first study mentioned, the mortality data were obtained from rabbits collected mostly in east-central Illinois (Champaign, Piatt, McLean, and Ford counties), and some in southern Illinois. The estimate in the second study was based on rabbits harvested in Michigan, Ohio, Wisconsin, Illinois, and Missouri. Thus, the similarity of the mortality rate for rabbits on the 100-acre study area at Robert Allerton Park to these other rates that applied to much larger areas gives support to the belief that data derived from work on the Allerton area are representative of other areas in Illinois and the Midwest. This emphasizes the high annual mortality of adult as well as young-of-the-year cottontails throughout their range.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | March, 1971 | Vol. 14, No. 3

1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

Because of the lack of snow cover during the winter of 1970-71, posthunt sex-ratio counts on the Sibley Study Area were confined to 3 days, February 23 and March 11 and 12. During these 3 days, the sex ratio indicated by observations of 562 pheasants was 37 cocks per 100 hens. Comparison of this sex ratio with the prehunt sex ratio in 1970, after corrections for differential juvenile survival and illegal hen kill, indicated that 50 percent of the available cocks were harvested during the hunting season, 1970. Similar calculations for the hunting season in 1969 indicated a harvest rate of 43 percent.

A success rate of 21.4 cocks killed per 100 gun-hours was recorded from hunter-interviews on the opening weekend of the hunting season in 1970. For the corresponding weekend in 1969, hunters reported a success rate of 23.3 cocks bagged per 100 gun-hours.

Although accurate data on the degree of hunting pressure in the 2 years are lacking, the combination of a higher harvest rate and a lower success rate in 1970, compared with 1969, suggests that the fall pheasant population in 1970 was slightly lower than in 1969. Because of wet weather during the fall trapping period in 1970, too few pheasants were marked to obtain a valid estimate of the fall population. Hence, supporting data for the decrease in pheasant numbers, suggested by the harvest data, are lacking.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

As a result of recent meetings with personnel of the Department of Conservation, the decision was made to attempt to establish an untreated-roadside management area. There will be no seeding of roadsides in this area. Farmers will be asked to delay mowing of roadsides until late summer. Studies of seeded and of unseeded roadsides in the Sibley Area indicate that delayed mowing of unseeded roadsides substantially increases utilization of these roadsides by nesting pheasants. It is thought that an attempt should be made, on a limited scale, to determine the response of farm operators to a request for delayed mowing of existing roadside vegetation, with no seeding involved.

An area of approximately 16 square miles in northwest Champaign and southwest Ford counties has been chosen for the experiment. A procedure similar to that followed for the Ford County Management Unit will be utilized with respect to planning and assessment of results. That is, Survey personnel selected the area, and will provide lists of farm operators and other necessary data and check on the progress of mowing in the area. Department personnel will contact the farm operators. As with the FCMU, signs will be placed at the entrances to the area. This undertaking will perhaps give some indication of the potential of this approach for future management programs.

3. Ecology and Management of Squirrels — C. M. Nixon

Average implantation rates of adult ($>$16 months) and yearling (10-12 months) gray squirrels vary with the age of the female (MWRL 14 (1):2) and also with the season of breeding. Placental scar counts from adults (N=40) breeding during the winter months showed a mean and standard error of 2.70 ± 0.14 scars per female. Scar counts from adults (N=63) breeding during the late spring and summer months showed a mean and standard error of 3.49 ± 0.11 scars per female. This difference in mean scars per female was statistically significant ($P < 0.01$). Yearling females (N=23) breeding during the winter months averaged 2.43 ± 0.12 placental scars per female, whereas yearlings (N=35) breeding during the summer months averaged 2.51 ± 0.13 scars per female. This difference was not statistically significant ($P > 0.05$). Apparently, the physiological adjustment necessary for successful estrus, implantation, and gestation is much the same for the yearling breeder during both breeding periods. Yearlings may require one full breeding cycle to allow all the glands involved in the breeding process to attain their optimal interrelation with each other.

For adult breeders, the ingestion of green leafy foods, fungi, insects, and fresh seeds, drupes, and samaras prior to and during the summer breeding period provides females with a higher level of nutrition, compared with winter breeders. Improved nutrition, particularly diets rich in protein and vitamins A, B, and E, improves prolificacy for domestic animals and probably accounts for the higher fecundity found in summer-breeding gray squirrels.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, D. R. Vance

Bobwhites in the northwest portion of the Dale Area increased in number from 49 quail per 100 acres in November 1969 to 65 quail per 100 acres in November 1970, an increase of 33 percent. This increase occurred even though the total quail population on the Dale Area exhibited a slight decline during the same period. From 1965 through 1969, this 261-acre portion of the Dale Area was managed primarily by establishment of food patches. In 1970, 98 acres--representing approximately 75 percent of the open land that could be cropped--were sharecropped; 71 and 27 acres were planted to corn and soybeans, respectively.

This dramatic response by quail during the initial year of the sharecropping programs was the third such response recorded on the Dale and Forbes areas since 1966. These data also reinforce our contention that periodic disturbances such as sharecropping and prescribed burning initiate those stages of plant succession to which the bobwhite is evolutionarily adapted. Such disturbances are essential to any program of quail management.

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier

During the years 1963 through 1968, only an occasional pheasant cock was seen or heard crowing on the Bogota Study Area, and no adverse interactions were noted between pheasants and prairie chickens. However, in the spring of 1969, at least four crowing cocks were seen or heard on the Bogota Area, and the first pheasant nest on a prairie chicken sanctuary was found during the summer of 1969.

During the spring of 1970, at least six pheasant cocks were noted at Bogota. On April 8, 1970, a pheasant cock succeeded in intimidating and driving a prairie chicken cock from a site burned for a booming ground on the Mark 40 Sanctuary. The pheasant cock subsequently began courting a nearby harem composed of a prairie chicken hen and a pheasant hen. A booming ground did not become established on the Mark 40 Sanctuary in 1970. Seven pheasant nests were found on the sanctuaries in 1970, and one hatched prairie chicken nest was found that contained 15 prairie chicken eggs plus 4 hatched pheasant eggs.

An increased pheasant population is again evident at Bogota on the basis of winter (1970-71) observations, and aggressive interactions between pheasants and prairie chickens are being observed on the Donnelley and Yeatter sanctuaries. On December 30, 1970, a single pheasant cock was observed "taking on" about 40 prairie chicken cocks near the Donnelley Sanctuary. The pheasant cock was successful in maintaining a territory in the center of the booming ground by persistent aggressive display from which the prairie chicken cocks cowered and repeatedly retreated. Also this spring, similar aggression by a pheasant cock appears to be causing the collapse of a traditional booming ground on the Yeatter Sanctuary.

These observations indicate the need for pheasant-control measures at Bogota. They also indicate an additional problem to be expected should prairie chicken restoration be attempted in the established pheasant range of Illinois--Goose Lake Prairie in Grundy County, for example.

6. Rabbit Management G. B. Rose

As described in MWRL 14(2):3-4, cottontail rabbits were livetrapped each fall from 1956 through 1970 on the 100-acre study area (4-H Area) at Robert Allerton Park.

Hunting was conducted on the study area during 1956 through 1959, 1961, 1963, 1966, 1968, and 1969. A life table was set up for the combined years that followed those in which hunting occurred on the study area, beginning with 1960, and another table was constructed for the years not following hunting-years. The mortality rate for the first year of recapture in the years that followed hunting-years was estimated to be 0.92, while the mortality rate for the first year of recapture in the years that did not follow hunting-years was 0.67. This illustrates an apparent contribution of hunting to annual mortality, supporting Bailey's observation in his Job Completion Report, 1965, that total fall-to-spring mortality was greater in years when there had been a harvest.

The differing mortality rates suggest that nonhunting mortality during the winter is not entirely compensatory, that is, that factors producing mortality in winters of no hunting did not entirely overcome the differential and produce a mortality rate equal to that in years when there was hunting. Instead, the nonhunting mortality, although it may be partially compensatory, was also partly additive, yielding higher mortality rates when there was hunting than when there was not. However, although hunting increased the total mortality, the fall populations were not correlated with the preceding years' hunting. Thus, greater mortality resulting from hunting was apparently compensated for by either a greater production of young, or, more likely, by increased survival of young in the summers or falls that followed hunting.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | April, 1971 | Vol. 14, No. 4

1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

Preliminary criteria for distinguishing juvenile and adult pheasants in east-central Illinois, based on measurements of proximal (innermost) primary feathers, were presented in MWRL 13(3):1. These preliminary criteria were based on data obtained from pheasants captured during the year 1969-70. A second year's data on proximal primaries were collected during the fall and winter of 1970-71. Mean proximal-primary shaft diameters (PPSD) and standard deviations for each sex- and age-class were calculated for each season and year. As no significant differences in mean PPSD between years could be demonstrated, the data for the 2 years were combined, and revised criteria for separation of age-classes were calculated.

A sample of 307 cocks collected during October and November, 1969 and 1970, separated at 3.21 mm (0.1265 inch) with 92 percent reliability. A sample of 46 cocks collected during January and February, 1970 and 1971, separated with 98 percent reliability at the same measurement.

A sample of 285 hens captured during October and November, 1969 and 1970, separated at 2.91 mm (0.1145 inch) with 90 percent reliability. A sample of 234 hens captured during January and February, 1970 and 1971, separated at 2.86 mm (0.1125 inch) with 92 percent reliability.

The lower degree of reliability of age separation of both sexes in fall, compared with winter, and the smaller separation measurement of hens captured in winter, compared with those captured in fall, apparently resulted from the fact that the mean PPSD of juveniles in winter samples were significantly smaller ($\underline{P}<0.01$) than those of juveniles in fall samples. Further examination of these data revealed that the PPSD of juveniles increased significantly ($\underline{P}<0.01$) with seasonal progression, that is, the proximal primary feathers of juveniles that hatched and, consequently, molted early in the nesting season were smaller when fully grown than those of juveniles that hatched later. Conversely, the PPSD of adults decreased significantly ($\underline{P}<0.05$) with advancing dates of molt initiation.

Although there is no apparent explanation for these seasonal changes in PPSD, it seems likely that the smaller mean PPSD of juveniles in winter, compared with fall, resulted from lower fall-to-winter survival rates of late-hatched juveniles (with large primary feathers), compared with early-hatched juveniles.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

The cooperative project for the experimental management of roadside cover along Highway 47, involving the Illinois Division of Highways, the Department of Conservation, and the Natural History Survey, was outlined in a previous report (MWRL 12(12):1-2). This is a study of the feasibility of managing vegetative cover, along a state primary highway, to benefit song and game birds: cover that is compatible with the basic objectives of roadside maintenance and the safe, orderly movement of vehicular traffic.

The 3 miles (both sides) of unmowed seeded roadsides have presented a relatively weed-free and uniform appearance. No complaints about the seedings have been received from either the motoring public or the adjacent farm operators. Comparisons, during 1969 and 1970, of the frequency of pheasant roadkills adjacent to the seeded plots with those adjacent to nearby unseeded and mowed roadsides showed no differences for both sexes combined, no differences for hens alone, but significantly more cock pheasants killed adjacent to seedings than adjacent to unseeded roadsides (MWRL 14(2):1-2). The meaning of these data is unclear at this point, as the small sample of seeded roadsides (3 miles) precludes any definitive assessment of the effect of seedings on the frequency of roadkills. This would be true regardless of whether the data showed an increase, no change, or a decrease in the frequency of roadkills adjacent to unmowed seeded plots as compared with mowed unseeded roadsides.

For this reason, the Division of Highways agreed to increase the number of seeded roadsides involved in the project. The greater number of seedings will allow a more exact evaluation of the question of pheasant roadkills. The project has been expanded to include seedings along 16 miles of roadside (on both sides) of the 68 miles of highways from Forrest to Gilman (Highway 24), Gilman to Ashkum (Highways 54-45), Ashkum to Saunemin (Highway 116), and Saunemin to Forrest (Highway 47). Since highway roadsides in three counties (Ford, Livingston, and Iroquois) are involved, the segment has been designated the F.L.I. Area. Brome and alfalfa were seeded (on the backslopes only) by personnel of the Department of Conservation and a local farmer during the week of April 12-16. Seeded areas will remain unmowed. Beginning in 1972, the F.L.I. Area will be driven at regular intervals during the spring and early summer in an attempt to detect any differences in the frequency of pheasant roadkills adjacent to seeded and unseeded roadsides.

3. Ecology and Management of Squirrels — C. M. Nixon

Livetrapping of fox squirrels was undertaken for 9 consecutive days during February 1971 to derive an estimate of the number of squirrels wintering on a 46-acre, mature oak-hickory forest located within the Allerton Park Sanctuary. Traps were placed at random, one trap per 0.889 acre, and baited with English walnuts.

A total of 29 squirrels were captured one or more times, and estimates of population size were derived from the frequency distribution of all captures. An estimate of 43 squirrels was derived from a linear regression

plot of capture frequencies converted to logarithms. The maximum likelihood estimation for a geometric distribution of capture frequencies was 67 squirrels. Expected capture frequencies calculated for both methods did not differ significantly ($\underline{P} > 0.05$) from the observed captures. A total of 41 individual squirrels were actually captured on this area between early January and mid-March 1971.

Because of a large number of denning sites and an abundant annual seed crop, the mature forests of Allerton Park are high-quality squirrel habitat. The late-winter density of about one fox squirrel per acre, found at Allerton, is probably high for this species and may only occur in such old-growth forests. Certainly, the forests of Allerton Park provide a much more productive habitat for squirrels than most of the remaining forests of east-central Illinois.

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis,
D. R. Vance

Analysis of 1,634 bobwhites harvested on the Dale Area and of 2,047 harvested quail from the Forbes Area provided some insight into the sex and age ratios during the fall and early winter for the years 1964-70. As expected, the sex ratio among the juveniles on both areas was 50:50. This ratio among the juveniles changed appreciably as the birds became adults. On Dale, the mean sex ratio among adults was 63 percent males. On Forbes, the mean sex ratio for the adults was 57 percent males. The differential sex ratios among the adults were attributed to the loss of hens during reproductive efforts, nesting and brooding.

The long-term mean age ratios were 17 percent adults on Forbes and 15 percent adults on Dale. These data agree generally with the turn-over rates of 80-85 percent, for quail populations, reported in the literature.

5. Response of Prairie Chickens to Habitat Manipulation

R. L. Westemeier

As in the past eight springs, booming ground surveys were conducted this spring on the Bogota Study Area at no less than weekly intervals from mid-March through mid-April. These data were supplemented by observations recorded by visitors in blinds on booming grounds. Counts were made during the first hour after daybreak, and an effort was made to determine the maximum number of cocks on the area.

The peak count of 159 cocks at Bogota this spring was 47 percent higher than the peak count in the spring of 1970. This is the third consecutive increase in the Bogota flock. The count this spring is 104 percent higher than the count made in 1963, when this census was initiated, and 330 percent higher than the low year of 1968.

Except for three minor booming grounds involving only two or three cocks each, all booming was located on or within 200 yards of the sanctuaries. Between 1970 and 1971, the counts roughly tripled on the Otis, Field, and

Mark sanctuaries. They were 75 percent higher on the Yeatter Sanctuary and 63 percent higher on the Donnelley Sanctuary. The count of cocks (seven) remained about the same on the C. McCormick Sanctuary, but the number of hens (up to 25) seen on the booming ground this spring was at least three times higher than in 1970. The J. Woods ground (on private land) lost approximately 24 cocks since last spring but still held about 30 cocks through this spring. The only discouraging note regarding the dispersion of prairie chickens at Bogota this spring was the lack of booming cocks on or near the 80-acre J. McCormack Sanctuary, which is located on the southern edge of the study area.

6. Rabbit Management

G. B. Rose

During the fall trapping on the 4-H Camp area at Robert Allerton Park in 1970, lengths and weights of captured cottontail rabbits were determined at the first capture during each month, and weight-length relationships were used to calculate condition indices, using the formula: $C.I. = \frac{W-16}{L^3}$, where W is the weight in grams and L is the length in decimeters (Bailey, J. A. 1967. MWRL 10(7):3). The mean condition index for October (91 rabbits) was 5.38, for November (102 rabbits) was 5.39, and for December (79 rabbits) was 5.46. The differences among the means for the 3 months were not statistically significant at the 95 percent level of significance, although Bailey had found highly significant differences among the months November through March during the years 1964 through 1967.

The monthly means for October, November, and December 1970 were all less than the means for the corresponding months of 1968 and 1969. The differences were significant at the 99 percent level of significance. These differences may indicate that the population was in a less favorable energy balance in 1970 than in the previous 2 years; or they may reflect a greater turnover of rabbits in the population, because the newer cottontails tend to have lower condition-index values than do cottontails that have been on the study area for a longer time.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | May, 1971 | Vol. 14, No. 5

1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

During the period April 20-29, 1971, systematic counts of pheasants were conducted along 57 miles of all-weather roads on the Sibley Study Area. Since 16 miles of these roads border the study area and observations are confined to only one side of the road, actual mileage for both sides of the road is 49 miles. As in the past 2 years, the observation period was confined to the first 2 hours after sunrise, which allowed coverage of half the roads each morning. Four counts were obtained for each road. Counts conducted during the period April 27-May 6, 1970, followed these same criteria.

These counts revealed 46 percent more cocks in 1971 than in 1970. The count in 1971 recorded 325 cocks (168 per 100 miles), compared with 222 cocks (114 per 100 miles) in 1970. Winter sex ratios obtained during periods of snow cover in 1970 and 1971 were 40 and 37 cocks per 100 hens, respectively. By using these figures, indices of 555 and 878 hens were calculated for 1970 and 1971, respectively, an increase of 58 percent.

These data suggest that pheasant survival during the mild winter of 1970-71 was considerably higher than during the winter of 1969-70, when snow cover persisted for a considerable length of time. However, abnormally low precipitation from January to April in 1971 resulted in a marked retardation of vegetative growth, and the shorter cover may have allowed the observation of a greater proportion of pheasants in 1971 than is normally possible. Thus, the magnitude of the increase in pheasant numbers indicated by the spring counts in 1971 may be somewhat inflated.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

Over the past several years a few miles of roadside have been graded each summer in the course of road-maintenance work in each of the several townships in the vicinity of Sibley. This work is generally associated with roadbed preparation for application of blacktop material to the road surface, for improvement of drainage, or both. The extent of such work is unknown and no doubt varies from township to township. In the immediate vicinity of Sibley, it is estimated that 2 to 4 miles (on both sides of the road) of roadside per township have been graded each year for the past several years. The Department of Conservation and the Natural History

Survey are now attempting to ascertain the extent of these graded roadsides in Ford, McLean, and Iroquois counties preparatory to determining the feasibility of seeding the roadsides with brome and alfalfa. It is believed that at least two advantages would accrue from setting up a program of treating these roadsides at the end of each summer: (1) Satisfactory nesting cover for pheasants, although on a limited scale, would be developed on roadsides that would otherwise be of little value as nesting cover for several years after grading; and (2) a wide area would be covered, bringing many different farmers and township road commissioners into contact with the program. Because these roadsides usually constitute somewhat of an erosion problem for a few years after grading (since they lack much vegetation), it is expected that both road commissioners and farmers will cooperate with the program.

3. Ecology and Management of Squirrels — C. M. Nixon

An infestation of scabies or mange, caused by a mite of the genus *Sarcoptes*, is often endemic in fox squirrels in winter. During the winter of 1970-71, a moderate infestation of mange was found in the fox squirrel population inhabiting a 46-acre forest located within the Allerton Park Sanctuary. The rate of infestation increased from November (12.5 percent, N=8) to March (43.8 percent, N=16), when livetrapping ceased. Adult squirrels had a slightly lower rate of infestation (32.7 percent, N=52) than did subadults (35.4 percent, N=48), but the difference was not significant ($P < 0.05$). Only two squirrels were found to be extensively depilated and one of these subsequently died in a live trap. Most squirrels were infected only on both ears and on the dorsal surface of the neck and shoulders.

The rate of infection of scabies may be related to dietary deficiencies that render individual squirrels more susceptible to infection during the winter months. A high-density population, such as occurs on the Allerton Sanctuary (MWRL 14(4):2-3), may also increase contact among individual squirrels and facilitate the spread of the infection. Most squirrels seem to recover readily during the spring and summer, but individuals extensively depilated often die, presumably because body heat cannot be retained during the cold winter months.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis, D. R. Vance

One of the factors possibly influencing the decline in the population abundance of quail in the experimental management zone on Forbes, in spite of the sharecropping program, has been the continued depletion of soil nutrients through cropping. This zone on Forbes has been cropped at moderate intensity for 5 years without replenishment of N, P, K, or $CaCO_3$. Soil samples taken from plots in the experimental zone on Forbes in 1970 indicated levels of soil fertility well below those recommended for normal crop production. The infertility was evident in crop yields and in the vegetation on the plots. The poor quality of the vegetation

was particularly evident in the small-grain stubble fields. The first year (1967) resulted in a luxuriant stand of oats and in a good stand of lesser ragweed (Ambrosia artemisiifolia) after the oats were harvested. In contrast, in 1970 the oats crop was poor, and lesser ragweed in the stubble fields was replaced by green foxtail (Setaria viridis), crabgrass (Digitaria ischaemum), and buttonweed (Diodia teres). The ragweed-stubble complex not only afforded ideal night-roosting cover but was also an abundant source of a highly utilized food item.

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier

Results of booming ground surveys conducted in nine areas in seven counties of south-central Illinois in the spring of 1971 revealed a total of 222 prairie chicken cocks. The 159 cocks censused at Bogota comprised 72 percent of the statewide total and showed an increase of 47 percent since the spring of 1970. Five cocks were censused for the first time this spring near Bible Grove in Clay County. The remaining 58 cocks on seven areas outlying the Bogota Area represent a loss of 28 percent since last spring. Losses of 50 percent or more occurred at Kinmundy-Forbes Park (13 cocks to 6 cocks), La Clede (3 cocks to 1 cock), Loogootee (17 cocks to 8 cocks), and Hoyleton (4 cocks to 2 cocks). The Farina Area continued to hold the largest flock outside of Bogota, but the count at Farina was 14 percent lower than last spring (28 cocks to 24 cocks). As in the past two springs, four cocks were found at Fairman in western Marion County. A relatively stable population was also noted near Mt. Erie in Wayne County, where the counts were 12 cocks in 1970 and 13 cocks in 1971.

Two sanctuaries totaling 320 acres (Survey 160 and Butler 160) are now established in Marion County in the Kinmundy-Forbes Park Area, and one tract of 140 acres (Lacey 100 and a new acquisition of 40 acres) is now available in the Farina Area. Booming cocks and hens were observed this spring, for the first time since acquisition, on both the Butler and Lacey sanctuaries. Although the prairie chicken flocks near these sanctuaries are at a critically low level, their prompt recovery seems likely because of the responsiveness demonstrated by this native grouse at Bogota in Jasper County.

6. Rabbit Management G. B. Rose

Energy consumed per day (MWRL 13(2):4-5) by cottontail rabbits during the period June 1970 through May 1971 was negatively correlated with ambient temperature. The correlation was highly significant for rabbits in outdoor cages and for rabbits in outdoor pens. The regression equation for the caged rabbits is $\hat{Y} = 88.75 - 0.449X$, and for the penned cottontails is $\hat{Y} = 124.50 - 0.503X$, when X is the mean air temperature for the experimental period and Y is the number of grams of commercial rabbit chow consumed per rabbit per day.

Daily energy consumption per gram of body weight is also negatively

correlated with ambient temperature. The relationship is given in the equation $\hat{Y} = 0.079 - 0.00044X$ for the caged cottontails, and $\hat{Y} = 0.105 - 0.00037X$ for those in the pens, when X is the air temperature and Y is the number of grams of rabbit chow consumed daily per gram of body weight.

The inverse relationship between energy utilization by the rabbits and air temperature probably results from the decreasing requirements of energy for thermoregulation by homoiothermic animals as the zone of thermoneutrality (the range of temperatures at which no energy is expended for maintenance of body temperature) is approached. The correlation between energy consumption and ambient temperature appears to be closer if the data from the spring of the year are excluded, which suggests the influence of endocrine changes associated with the breeding season, or that full acclimation to the summer temperatures may be slow.

The greater energy utilization by the cottontails in the pens than by the caged rabbits may reflect the greater activity by the penned rabbits, compared with the more confined rabbits in the cages. Thus, estimates of energy consumption by penned rabbits should better approximate the energy comsumption of free-ranging cottontails.

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OCT 1971

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois June, 1971 Vol. 14, No. 6

1. Pheasant Populations and Land Use

S. L. Etter,
R. E. Greenberg

During the 5-year period 1962-66, all of the available indices of pheasant abundance indicated pronounced decreases in numbers of pheasants on the Sibley Study Area. There were, however, marked differences in the magnitude of population losses indicated by summer roadside indices and those obtained by other means.

Summer roadside counts in 1966 recorded 18.7 broods per 100 miles, compared with 36.3 broods per 100 miles in 1962, a decrease of 48 percent. The number of successful nests projected from sample plots in 1962 and 1966 were 1,721 and 367 nests, respectively, a decrease of 79 percent. Projections based upon cock call counts in 1962 and 1966 indicated a decrease of 80 percent in late-summer pheasant numbers. The number of pheasants flushed per 100 acres, during nightlighting, decreased from 213 in 1962 to 63 in 1965, a decrease of 70 percent. Too few acres were nightlighted in 1966 to obtain a valid index.

These data indicated that the summer roadside counts underestimated the magnitude of population losses. Apparently, then, a larger than usual proportion of the pheasant population was observed on roadsides as the acreages of other types of nest cover and brood cover decreased on the adjacent cropland. These findings raise serious questions concerning the validity of roadside counts as indices of pheasant abundance and suggest that additional data on the acreages and use of other cover types by pheasant broods are needed if accurate indices of late-summer pheasant numbers are to be obtained.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

The preceding monthly report (MWRL 14(5):1-2) described efforts currently under way by Survey and Department of Conservation personnel to determine the miles of roadside that have been graded in Ford, McLean, and Iroquois counties in the course of road-maintenance work. These efforts are preparatory to determining the feasibility of seeding the roadsides with brome and alfalfa.

Data provided by the Superintendent of Highways of Ford County indicate that grading has been undertaken during 1970 and 1971 along approximately 64.5 miles of roads in the county (both sides). This is

the equivalent of roadsides around 16 square miles. Nearly 40 of these miles were graded in 1970. We do not yet know which segment of these miles would be suitable for seeding. The Superintendent indicated that grading is planned along approximately 20 miles of roads in the county each year for 10 years, and that the County Highway Department would be willing to cooperate with the Department of Conservation should a decision be made to seed these roadsides.

3. Ecology and Management of Squirrels

C. M. Nixon

Intensive livetrapping was undertaken at Allerton Park between December 1970 and March 1971 to determine the breeding period for female fox squirrels. A total of 12 females of breeding age were each captured numerous times, and 11 of these experienced an estrous cycle during the study period.

Breeding commenced the first week in January. The vulva of a female captured January 2 was swollen, indicating approaching estrus. By January 25, all 11 females had undergone an estrous period and were pregnant. The winter breeding period in 1971 was somewhat later than the late December-early January breeding peak found during an earlier study of fox squirrel breeding in central Illinois.

The factors responsible for initiating estrus are not well defined for either gray or fox squirrels. Although both the winter and summer breeding periods for both species occur under conditions of increasing photoperiod (January and late May-early June), there is insufficient data available to prove that increasing photoperiod is the principal factor initiating breeding. In most years, a few females of both species will experience an estrous cycle in late summer when the photoperiod is decreasing. It is known that adverse environmental factors, such as a severe winter or a lack of staple foods, will often delay or eliminate breeding, particularly in gray squirrels.

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis,
D. R. Vance

Importance values (MWRL 13(7):2) were calculated for plants on burned and nonburned plots (1966) in the prescribed burn zone and on plots sampled in 1970 that were burned in 1968 and 1970 or in 1969 and 1970. These data indicated that changes in the vegetation on these plots over the 4-year period were not dramatic but subtle. Goldenrod (*Solidago* spp.) and lanceleaf ragweed (*Ambrosia bidentata*) continued to exhibit dominance in 1970 as in 1966. Rough buttonweed (*Diodia teres*), an important plant in 1966, declined in importance during the 4 years. The reverse occurred in the case of partridge pea (*Cassia fasciculata*) -- not an important plant in 1966 -- which gained in importance value during the 4 years. The bush clovers (*Lespedeza striata* and *L. stipulacea*) maintained the same level of importance in 1970 as in 1966. Another important quail food, lesser ragweed (*Ambrosia artemisiifolia*), exhibited a response to the prescribed

burns similar to that of the bush clovers. Trailing wild beans (_Strophostyles_ spp.), readily accepted by quail as food, increased in importance value during the 4 years. The absence of fires would probably have resulted in the loss of these vital quail-food plants from the habitat.

The prescribed burns were primarily successful in maintaining an open-meadow type of habitat. Blackberries (_Rubus alleghenienis_), although not eliminated by fire, are restricted in their spreading. The burned plots have not been invaded by plants of the early woody stage--for example, smooth sumac (_Rhus glabra_), persimmon (_Diospyros virginiana_), and sassafras (_Sassafras albidum_).

5. Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier

Searches for prairie chicken nests were conducted one or more times on a total of 409 acres (110 plots) after prescribed burning in 1968, 1969, or 1970 on the Bogota Study Area. One objective of burning is to learn whether fire can be a useful tool in maintaining the attractiveness of sanctuary grasslands for nesting hens. The burned fields (mostly consisting of redtop or timothy) were categorized as follows:

> March burn I (108 acres--38 plots), the first growing season after a March burn; August burn I (125 acres--28 plots), the first full growing season after an August burn; March burn II (94 acres--25 plots), the second growing season after a March burn; August burn II (51 acres--13 plots), the second full growing season after an August burn; and March burn III (31 acres--6 plots), the third growing season after a March burn.

No nests have yet been found in the March burn I type, and only two nests have been found in the August burn I type (62.5 acres per nest). However, 14 nests have been found in March burn II types (6.7 acres per nest), and 13 nests have been found in August burn II types (4.0 acres per nest). So far, only one nest has been found in 30.7 acres in the third growing season after a March burn. In 1970, three fields of timothy totaling 12.3 acres contained nine nests (1.4 acres per nest)--the fields had been burned in March or August of 1968.

Thus, the data collected to date on prescribed burning indicate the usefulness of the technique of burning for renewing the attractiveness of old sods for nesting hens. One full growing season after a prescribed burn, a stand of cover appears to have an attractiveness equal to or exceeding that of sods in their second growing season after plowing and reseeding. Nest data for 1971 should provide increased insight into the use made of cover in the third growing season after burning.

6. Rabbit Management

G. B. Rose

Stomach contents of wild cottontail rabbits, collected in the evening when the rabbits were feeding, were obtained over a period of several months in an effort to determine whether there are seasonal changes in the quality of the food ingested, in the time from late winter through late spring. Energy content and percentage of protein were considered to represent "quality." Changes in quality of food ingested might suggest changes in food availability. For example, a decrease in quality of the food taken by the animals might indicate a decrease in the availability of food of high quality.

Stomach contents from eight adult cottontail rabbits, which had been collected between 9 PM and midnight from February through June 1971, were analyzed for energy content by combustion of dried samples in a Parr adiabatic bomb calorimeter. Samples were also analyzed for percentage of nitrogen by the Kjehldahl method; and percentages of crude protein were estimated by multiplying the percentage of nitrogen by a factor of 6.25.

Caloric values ranged from 3.886 kilogram calories per gram dry weight to 4.454 kcal/g, and averaged 4.170 kcal/g. There appeared to be no seasonal trend in the caloric value of the material in the stomachs for the period from February through June. Similarly, percentages of crude protein, which ranged from 13.6 percent to 29.6 percent and averaged 21.4 percent, also exhibited no seasonal trend. Thus, these data show no seasonal change from late winter through late spring in the quality of the food ingested by wild cottontails.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois July, 1971 Vol. 14, No. 7

1. Pheasant Populations and Land Use S. L. Etter

The general dependence of pheasant abundance on small grains, forage crops (hay and rotation hay pasture), and grassy permanent cover was pointed out in an earlier report (MWRL 14(2):1). Although these cover types are generally thought of in relation to nesting, data from the nesting study suggest that the relationship of pheasant abundance to land use is more complex than a simple dependence on nesting cover. If nesting cover was the major factor limiting pheasant abundance, nest densities would be expected to increase or at least stabilize at some high level as the amount of nesting cover decreased. Data from the nesting study, however, indicated that nest densities were higher when nesting cover was more abundant and decreased as nesting cover became less abundant.

Despite a 69 percent decrease in hay acreage on the Sibley Study Area from 1963 to 1967, nest densities in this cover type decreased from 3.13 nests per acre to 1.26 nests per acre. Nest densities on roadsides decreased from 1.82 nests per acre in 1963 to 1.00 nest per acre in 1967. Although some of this decline in nest densities may be attributable to increased proportions of poor-quality nesting cover and intensified mowing, pronounced decreases in nest densities occurred in all cover types, regardless of the degree of change in vegetative composition or in disturbance. Hence, nesting cover does not appear to be the only land-use characteristic influencing pheasant abundance. This does not necessarily indicate that the relationship of pheasant abundance to small grains, forage crops, and grassy permanent cover is spurious. However, these data suggest that the acreages of these cover types are more important during some other period in the annual cycle than they are during the nesting season.

As of July 1, 1971, R. E. Greenberg was transferred from this project to the Squirrel Project.

2. Manipulation of Pheasant Habitat G. B. Joselyn

Data provided by the Ford County Superintendent of Highways indicated that grading had been completed in 1970, 1971, or would be completed in 1971 along approximately 64.5 miles of roads in the county (MWRL 14(6):1-2). On June 30, all these roadsides were visited in order to determine the acreages involved and the feasibility of seeding the roadsides with the current complement of Department equipment.

It was determined that 44 miles of roadside (both sides) could be seeded. With respect to ease of seeding, 14 miles were judged fair; 24 miles, good; and 6 miles, very good. Approximately 172 acres are involved. Roadsides to be seeded occur in 9 of the 12 townships in the county.

3. Ecology and Management of Squirrels — C. M. Nixon, R. E. Greenberg

Recovery rates, or the proportion of tagged squirrels shot during a hunting season occurring immediately after tagging, were computed for adult and juvenile gray squirrels for each of 9 years, 1962-70. During this 9-year period, an average of 50 percent of the adult males, 47 percent of the adult females, 49 percent of the spring-born juvenile males, and 33 percent of the spring-born females were shot.

The average annual mortality rate for adult squirrels for this same 9-year period was 64 percent. By the simple subtraction of hunting mortality from annual mortality, nonhunting-induced mortality is found to total about 15 percent for adult squirrels during the 9-year period. Some of this so-called natural mortality is undoubtedly hunter-induced crippling loss.

Recent studies of unhunted gray squirrel populations in Virginia and North Carolina have found a much lower annual mortality rate for adult squirrels, usually between 40 and 50 percent. For the population cited above, hunting mortality at least partially compensates for natural losses, but total annual mortality is higher in the hunted population--in this case, between 14 and 24 percent higher than that of an unhunted adult squirrel population.

R. E. Greenberg joined this project as Assistant Project Leader effective July 1, 1971.

4. Responses of Bobwhites to Habitat Manipulation — J. Ellis

Three plants, serecia lespedeza (*Lespedeza cuneata*), multiflora rose (*Rosa multiflora*), and red pine (*Pinus resinosa*) were used by the Department of Conservation in the initial work of development on the prescribed burn zone on the Dale Area. All three species have been included in the prescribed-burn program, either by design or accident, since 1966. The periodic burning has enabled serecia to maintain itself in a persistent, self-rejuvenating state. The multiflora rose, used to divide fields and as border strips, has been largely prevented, by burning, from spreading into the open fields. On two occasions, small stands of red pine were accidentally burned--not more than 2 acres altogether. Within 6 months, the burned pines were indistinguishable from the neighboring unburned pines. If pines are to be used in the developmental phase in management of newly acquired areas, the use of red pine is recommended for this purpose because it is a fire-tolerant species.

As of July 1, 1971, D. R. Vance was transferred from this project to the Prairie Chicken Project.

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier, D. R. Vance

Weather is one of many factors that can affect reproductive success of prairie chickens. After a relatively dry fall and winter, precipitation in east southeastern Illinois in March, April, and May 1971 amounted to only 6.6 inches, in contrast to the norm of 11.7 inches (data from the Illinois Cooperative Crop Reporting Service). During April, an important period for the initiation of prairie chicken nests, precipitation amounted to only 0.9 inch--2.9 inches short of normal. Drought conditions were even more pronounced on the Bogota Study Area.

The basic effect of the dry spring was to promote early and complete tillage of cropland for spring planting of corn and soybeans. The early tillage resulted in little choice of nesting cover for prairie chickens other than the sanctuaries and the acres diverted from crop production through the Federal Feed Grain Program. No nests were reportedly destroyed by tillage operations at Bogota this spring. While the early tillage and the resultant lack of nest destruction were beneficial to prairie chickens, the drought conditions delayed the phenology of vegetation on the sanctuaries. The retarded growth of the vegetation on the sanctuaries, coupled with the lack of weedy grain stubble on private farmland, caused spring feeding conditions to be poor for prairie chicken hens at a time when the physiological demands of egg laying and incubation were critical. During the period 1963-70 at Bogota, the clutch size of 88 prairie chicken nests averaged 12.2 eggs. Annual means ranged from 10.7 to 13.0 eggs. On the basis of 25 completed clutches found so far at Bogota this summer, clutch size has averaged 10.3 eggs. This noticeable reduction in clutch size may be a function of the drought and the poor feeding conditions present this spring.

D. R. Vance joined this project as Assistant Project Leader effective July 1, 1971.

6. Rabbit Management G. B. Rose

Energy consumption per day (MWRL 13(2):4-5) and growth of adult cottontail rabbits were measured during the period from April through August 1970 and from April through July 1971. The amount of commercial rabbit chow consumed per day per rabbit averaged 57 grams for the rabbits in outdoor cages and 96 grams for those in outdoor pens, or 227 kcal per day for the rabbits in cages and 383 kcal per day for those in pens.

Growth per day, for the penned cottontails, averaged 1.53 grams or an estimated 2.64 kcal/day, and ranged from 0.003 to 6.01 kcal. The proportion of the energy consumed that was converted into growth averaged 0.69 percent (range, 0.00 to 1.40 percent), while the proportion of the estimated assimilated energy converted into growth, the net growth-efficiency, was 1.13 percent (range, 0.00 to 2.29 percent).

The growth per day for the caged cottontails averaged 0.29 gram, or an estimated 0.50 kcal/day, and ranged from a loss of 3.27 kcal to a gain of 5.34 kcal. The percentage of the energy consumed that was represented by growth (for the 7 animals that gained weight out of 10) was 0.76 (range, 0.06 to 1.94), while the net growth-efficiency averaged 1.24 percent (range, 0.11 to 3.17 percent).

Thus, although growth continued in adult animals, the net growth-efficiency is approximately 1 percent, and the remaining 99 percent is respiration.

The low, net growth-efficiency of adult rabbits is in expected contrast to higher net growth-efficiencies for juveniles, as expressed by the equation $Y = 40.44 - 0.038X$, when X is body weight and Y is percentage net growth-efficiency (Rose, G. B. 1970. Job Progress Report, unpublished).

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois August, 1971 Vol. 14, No. 8

1. Pheasant Populations and Land Use

S. L. Etter

A previous report (MWRL 14(7):1) indicated that the availability of nesting cover per se was not the only land use characteristic influencing pheasant abundance on the Sibley Study Area. The effect of changes in acreages of small grains, forage crops (hay and rotation hay pasture), and grassy permanent cover, all of which provided this nesting cover, was not, however, confined to the nesting season. The fall and winter cover provided by these cover types decreased from 3,560 acres in 1962-63 to 1,503 acres in 1966-67 (58 percent). As a consequence of the increased acreages of corn and soybeans that replaced small grains and forage crops, fall plowing increased from 11,943 acres in 1962 to 14,343 acres in 1966. Thus the fall and winter cover provided by small grains, forage crops, and grassy permanent cover was replaced by plowed fields.

Although the benefits of small grain stubble, forage crops, and grassy permanent cover to pheasants in fall and winter, except as roosting cover, is presently unknown, the replacement of such cover by plowed fields is obviously detrimental to pheasants. These data point out the need for more information on the survival and habitat utilization of pheasants during fall and winter. At present, however, it is obvious that land use changes effecting fall and winter survival have been equally as drastic as those effecting nest cover. Given the findings of the present study, it appears that future research should place primary emphasis on survival studies rather than on reproduction.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

Records of the Ford County ASCS office, Paxton, show that 137 individuals farm adjacent to graded roadsides that were selected for seeding in the county during September. For the 86 linear miles of roadside proposed for seeding, this number constitutes an average of 1.6 farm operators per mile. Lists of farm operators, along with maps indicating the land each farms adjacent to the graded roadsides, have been prepared and are now in the hands of Department Biologists. Using this material, the biologists are contacting individual farm operators to seek permission for seeding their roadsides. Each farmer is also being requested to refrain from mowing his roadside until July 31 or later beginning in 1972. Contacts of farmers began August 3; initial reports indicate most farmers are willing to participate in the program. Seeding is scheduled for mid-September.

3. Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

Livetrapping of a mixed gray and fox squirrel population was undertaken for 10 consecutive days during late May 1971 to derive an estimate of the number of squirrels located within a 70-acre, predominately pole sized, oak-hickory forest. Traps were placed at random, one trap per 0.89 acre, and were baited with English walnuts.

A total of 66 squirrels were captured one or more times, 60 fox squirrels and six gray squirrels. Estimates of population size derived from the frequency distribution of all captures were 113 (Regression Method) and 127 (MLE Method). Expected capture frequencies calculated for both methods did not differ significantly ($\underline{P}>0.05$) from the observed captures.

A total of 29 adults, 16 yearlings, 1 subadult, and 4 juvenile fox squirrels were captured. There were 33 males and 27 females in this sample.

A total of eight of 11 adult (1 year +) females (72.7 percent) had just completed nursing a litter.

A population density estimated at 1.7 per acre seems quite high for an immature forest. Of course, there are some mature trees located throughout the study area, particularly along the lower slopes and in the ravines found on the north portion of the study area. More mature forests are found adjacent to the south, west, and north boundaries of the study area. Undoubtedly, squirrels forage at considerable distances from these mature habitats. One tagged fox squirrel traversed the study area from south to north during the 10-day livetrapping period.

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

The prebreeding census of quail for 1971 on the Forbes and Dale areas was completed during early March. Results of this census indicated populations of 3.1 and 10.5 quail per 100 acres on the Forbes and Dale areas, respectively. The estimate for Forbes was 32 percent less than the corresponding estimate obtained in 1970. The estimate of the prebreeding population on Forbes in 1971 was lower than the long-term mean estimate of the prebreeding population (4.6 quail per 100 acres) and also represented a decline of 87 percent from the prehunt population level in 1970.

On Dale, the prebreeding population for 1971 was slightly higher than the corresponding estimate (10.0 quail per 100 acres) obtained in 1970. However, the prebreeding estimate in 1971 was 42 percent greater than the long-term mean (7.4 quail per 100 acres). The prebreeding estimate in 1971 represented a decline of 72 percent from the prehunt population level of 1970.

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier, D. R. Vance

Surveys of prairie chicken booming grounds at Bogota in autumn and winter have revealed that some booming grounds are consistently active during these seasons as well as in the spring. During the past 4 years only about one-third of the booming grounds that were active in the springs were also active the subsequent falls. In 1966, one-half of the spring grounds were active in the subsequent fall. Relatively large numbers of cocks are found on a relatively few booming grounds in the fall. During the past 2 autumns 50-75 cocks have commonly been noted, and in one instance 114 cocks were counted, on a single booming ground. Since 1963, the averages each spring of the number of cocks per booming ground have ranged from 3.6 cocks (1967) to 15.9 cocks (1971). Since 1966, the fall averages per booming ground have ranged from 11.5 cocks (1967) to 57.0 cocks (1970). Apparently, small grounds that were active in the spring condense into the larger grounds in the fall. The population (of cocks at least) remains concentrated on a few grounds through winter until March. In March, the number of birds on the few large grounds declines and at the same time new and smaller grounds appear. Thus, it seems that March is the time of dispersal and orientation of the population to nest cover. Clear, calm mornings are particularly conducive to display activities in autumn and winter; however, even on mornings with sub-zero temperatures, strong-north winds, cloud cover, and snow on the ground, territorial defense may be vigorous.

6. Rabbit Management G. B. Rose

A white cottontail rabbit was captured during the annual fall live-trapping on the 4-H Camp Area at Robert Allerton Park near Monticello, Illinois on November 7, 1968.

The rabbit was a male, weight 1,143 grams, and had a total length of 60.0 cm. The normally gray underfur was white over much of the animal's body although becoming light gray in the posterior portion. Some of the guard hairs were black tipped, although lighter than normal. The eyes were the normal dark brown color.

Casteel (J. Mammal. 1961. 42(4):541) shot a female white cottontail on the 4-H Area on December 4, 1959. The rabbit, specimen No. 21789 in the University of Illinois Natural History Museum, Urbana, was essentially identical to the male trapped in 1968.

These two rabbits have been the only white ones collected out of over 1,500 rabbits trapped or shot on the 4-H Area in the 15 years from 1956 through 1970.

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | September, 1971 | Vol. 14, No. 9

1. Pheasant Populations and Land Use

G. B. Joselyn

Standardized counts of pheasant broods, made on the Sibley Study Area during July and August 1971, recorded 23 percent fewer broods than in 1970. One hundred thirty-nine broods were observed along 640 miles of roadside transect (two 40-mile routes were driven each week); 180 broods were observed in 1970. The average size of broods judged to be completely counted was 4.5 chicks, a decrease of nearly 12 percent from the average of 5.1 chicks in 1970.

The number of adult hens observed along these same 640 miles decreased from 163 in 1970 to 157 in 1971 (almost 4 percent). Thirty-two percent of the adult hens observed in August 1971 were broodless, compared with 22 percent in August 1970.

The above indices suggest a slight decrease in pheasant numbers in late summer 1971, compared with 1970.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

Densities of pheasant nests in 1971 on seeded roadside plots averaged 3.5 nests per acre. Only in 1964 (3.8 nests per acre) was there a higher nest density during the 9 years of this investigation, 1963-71. The nest density this past summer was 25 percent greater than in 1970 (2.8 nests per acre). Low nest density for the 9 years was recorded in 1969 (1.7 nests per acre).

The nest density on managed control roadside plots in 1971 was 2.4 nests per acre, up 60 percent from 1.5 nests per acre in 1970. The density of 2.4 nests per acre in 1971 was also the second highest density on this type of roadside over the past 9 years; the highest density for the period was 2.8 nests per acre in 1963.

3. Ecology and Management of Squirrels

C. Nixon,
R. Greenberg

Only about 60 percent of the yearling (10-14 months) female gray squirrels breed during either of the two major breeding periods each year (MWRL 14(3):2). While the factors responsible for the attainment of puberty are not well defined for the gray squirrel, differences in body

growth rates between individual squirrels may reflect physiological differences in these animals that relate to the attainment of puberty. Using lens weights to determine females of the same age (within 1-3 months), whole body weights were compared from breeding and nonbreeding yearling females shot in early fall. Whole body weights from 28 breeding yearling females provided a mean and standard error of 516.3 ± 7.8 grams; whole body weights of 24 nonbreeding yearling females showed a mean and standard error of 499.0 ± 5.2 grams. This difference in body weight is significant at the 10 percent level ($P < 0.10$).

Whole body weights of both breeding and nonbreeding yearling females averaged over 90 percent of the mean whole body weight of adult (15 months +) females (N=119, $\bar{x}$=532.9 g). This would indicate that female gray squirrels do not usually attain puberty until nearly of adult size, at least during years of normal food supplies. During or immediately after years of exceptional food abundance, a few precocial females will breed when somatic growth is only 75 to 85 percent of that of the adult female.

The high proportion of total life-span energy required to reach puberty in this species means that adequate nutrition is particularly important for females from 3 to 10 months old, the period between weaning and approaching puberty.

4. Responses of Bobwhites to Habitat Manipulation — J. Ellis

Counts of whistling bobwhites along standardized routes on the Forbes and Dale areas may be used as indices of fall population densities (MWRL 12(9):2 and 13 (8):2) on the areas. Analysis of data for 1964-70 showed significant regressions ($P < .005$) of number of calls per listening stop on fall population densities. Predicted populations for the fall of 1971, based on these regression formulae, are 24.3 and 37.5 quail per 100 acres for the Forbes and Dale areas, respectively. These estimated densities represent a 10 percent decline in the prehunt density on Dale and a 14 percent increase in the prehunt density on Forbes, when compared with the estimates made in 1970.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier, D. R. Vance

A total of 63 prairie chicken nests were found on the sanctuaries at Bogota in the summer of 1971. Of these 63 nests, 41 were successful, 21 were abandoned and/or destroyed by predators, and the fate of 1 nest remained unknown. The success level of 66 percent was slightly under the mean of 68 percent for the 8-year period of 1963-70 but was slightly above the rate of success for 1970 (65 percent).

The density of 8.6 acres searched per nest is the best density recorded since 1964. The average density for 1971 exceeds the average density of 12.4 acres per nest for the period of 1963-70. Except for the newly acquired Fuson Farm, where no nesting cover was available, at least

one nest was found on every sanctuary at Bogota this summer -- including the 80-acre J. McCormack Sanctuary on the south edge of the study area.

6. Rabbit Management

G. B. Rose

Energy consumed per day (MWRL 13(2):4-5) by cottontail rabbits during the period February 1970 through July 1971 was negatively correlated with ambient temperature. The correlation was highly significant for cottontails in outdoor cages and for cottontails in outdoor pens. The regression of the number of grams of commercial rabbit chow consumed per day, Y, on the mean air temperature for the experimental period, X, is expressed as $\hat{Y}=117.48-0.362X$ for the rabbits in pens, and as $\hat{Y}=90.02-0.465X$ for the rabbits in cages.

Similarly, a highly significant negative correlation exists between daily energy consumption per gram of body weight and ambient temperature. The relationship is expressed by $\hat{Y}=0.108-0.00041X$ for the penned cottontails, and $\hat{Y}=0.079-0.00043X$ for those in cages, when X is the mean air temperature and Y is the number of grams of rabbit chow consumed per day per gram of body weight.

The inverse relationship between energy utilization by the rabbits and air temperature probably results from the decreasing requirements of energy for thermoregulation by homoiothermic animals as the zone of thermoneutrality (the range of temperatures at which no energy is expended for maintenance of body temperature) is approached.

The correlation coefficients (between ambient temperature and food consumed per day, and between ambient temperature and food consumed per day per gram body weight) for the caged cottontails were greater than for the penned cottontails, suggesting that confinement in cages restricts the opportunity for seasonal changes in activity, and thus results in a more direct relationship between ambient temperature and energy consumption than occurs with animals in pens.

Similarly, the correlation coefficients, for both caged and penned cottontails, between ambient temperature and grams of food consumed per day per gram body weight, were greater than the correlation coefficients between ambient temperature and grams of food consumed per day. Thus, the elimination of the variation caused by differences in body weight of individuals resulted in a closer relationship between ambient temperature and food consumption.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois October, 1971 Vol. 14, No. 10

1. Pheasant Populations and Land Use

G. B. Joselyn

Available pheasant nesting cover on the 23,200-acre Sibley Study Area continued to diminish in 1971. Excluding row crops (corn and soybeans), pheasant nesting cover on the area consists of hay (harvested and unharvested), hay pasture (cattle and hog), small grains (mostly oats), and permanent cover (roadsides, railroad rights-of-way, farmsteads, fencerows, etc.). Taken together, these cover types totaled 8,373 acres (36 percent of the land area) in 1962 but only 3,450 acres (15 percent) in 1971. Thus, total available pheasant nesting cover on the study area (excluding soybeans) has declined almost 60 percent since 1962.

Hayfields, the prime pheasant nesting cover, made up only 489 acres (2.1 percent of the land area) last summer, compared with 610 acres (2.6 percent) in 1970. In 1962, there were 2,192 acres of hay on the study area. Hayfield cover has therefore diminished nearly 78 percent in the past 10 years. Acreages of small grains declined only slightly from 1970 (1,022 acres) to 1971 (1,000 acres); in 1962 there were 3,457 acres of this crop on the study area.

The amount of permanent cover has remained relatively constant over the past 10 years. Cover in this category declined only 6 percent between 1962 (1,875 acres) and 1971 (1,763 acres). However, of the total acreage of permanent cover, only roadsides (350 acres each of the past 10 years) constitute even reasonably good pheasant nesting cover.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

In the last Monthly Wildlife Research Letter (14(9):1), it was reported that densities of pheasant nests this year (1971) on seeded roadside plots (3.5 nests per acre) represented the second highest rate of nest establishment on this type of roadside since the study began in 1963. The highest nest density reported over the past 9 years on seeded plots was 3.8 nests per acre in 1964. Nest densities on managed control plots in 1971 were 2.4 nests per acre, also the second highest density for this type of plot in the past 9 years, the highest density being 2.8 nests per acre in 1963.

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On seeded plots in 1971, successful nest production (0.7 nest per acre) was down slightly from production in 1970 (0.8 nest per acre).

Production on seeded plots has varied over the past 9 years from a high of 1.1 successful nests per acre in 1963 to a low of 0.5 successful nest per acre in 1967. Only 19 percent of the nests established on seeded plots were successful this year, the lowest percentage for the past 9 years; in 1964, 21 percent of the established nests hatched, representing the second lowest success rate for the period. The average rate of success on seeded plots since 1963 is 28 percent.

Production on managed control plots in 1971 was the same as that on seeded plots, 0.7 nest per acre, the highest rate of production on this type of roadside for the past 9 years. Lowest rate of production on managed control plots was 0.3 successful nest per acre in 1964. Twenty-nine percent of the nests established on managed control plots were successful in 1971.

Since 1963, 125 nests have hatched on seeded plots (0.8 nest per acre), compared with 82 nests on managed control plots (0.5 nest per acre).

3. Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

Timber stand improvement (TSI), as applied to the central hardwood forest, includes a variety of cultural treatments designed to enhance the growth rates of selected crop trees. TSI recommendations often include the removal of vines, usually grape, that might impede the future growth of potential sawtimber. Data collected in Ohio, West Virginia, and Illinois in recent years have shown that gray and fox squirrels seem to prefer to use high-climbing vines as a support for their leaf nests. Vine-supported nests seem to be better able to resist weathering than nests placed in tree crotches or on tree limbs.

During November 1970, a count of leaf nests was conducted in a 34-acre mature oak-hickory stand inhabited by fox squirrels. A total of 66 nests were found and 33 (50.0 percent) were anchored by one or more vines. A random count of 252 trees ($>$ 4.0 inches dbh) revealed that only 28.4 percent contained high-climbing vines. The difference between the number of squirrel nests with vines and the number of trees with vines is significant ($\underline{P}<0.01$).

Vine removal may particularly affect squirrels located in regenerating hardwood stands that contain few tree dens. Leaf nests provide the only sites for rearing nestlings in these stands and, without supporting vines, may not remain usable during the 10-week rearing period.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis

Quadrat samples of the vegetation were taken in July in 14 of the 16 plots burned on the Dale Area during early March. Seventy-four species were identified in the quadrats, and importance values (IV) were calculated (MWRL 13(2):2). Goldenrod (*Solidago* spp.) continued to be the most important plant in the burned plots (IV=18.8). The IV for goldenrod has varied from 22.7 in 1966 to 15.6 in 1968. Through 6 years of annual burning, goldenrod has remained a relatively stable species in this environment.

The annual burning has favored the growth and spread of serecia lespedeza (*Lespedeza cuneata*). Serecia was originally planted, during the program of initial development on the area, in strips adjacent to rose (*Rosa multiflora*) and woodland acreages. Serecia ranked second to goldenrod in importance in 1971 (IV=12.5), but in 1966, the IV for serecia was 3.0. Continued annual burning may result in goldenrod being superseded by serecia as the most important plant.

5. Responses of Prairie Chickens to Habitat Manipulation R. L. Westemeier, D. R. Vance

During the 8-year period of 1963-70, the sizes of 88 incubated clutches of prairie chicken eggs at Bogota ranged from 6 to 17 eggs. The mean number of eggs per incubated clutch ranged from 10.7 in 1966 to 13.0 in 1970 and averaged 12.2 for the 8-year period. The mean number of fertile eggs per incubated clutch (77 clutches) ranged from 9.8 in 1966 to 12.3 in 1970 and averaged 11.7 for the past 8 years. The mean number of hatched eggs per successful nest (79 clutches) ranged from 9.8 in 1964 to 11.6 in 1970 and averaged 11.3 for the 8-year period.

In 1971, the means were 10.5 for clutch size (31 clutches), 10.1 fertile eggs per clutch (27 clutches), and 9.5 hatched eggs per clutch (29 clutches). Each of the three means for 1971 was significantly lower ($P < 0.05$) than the means established for the preceding 8-year period. Also, the means for 1971 for clutch size and number of hatched eggs per successful nest were lower than any of the annual means established for previous years.

The reason for the lower reproductive performance of prairie chickens in 1971 is a moot question. One plausible explanation--drought conditions in the spring of 1971 at Bogota--was discussed in a previous report (MWRL 14(7):3).

6. Rabbit Management

G. B. Rose

Food consumption (MWRL 13(2):4-5) was measured for cottontail rabbits in cages and in pens for weekly periods from June 1970 through July 1971.

The relationship, for the rabbits in the cages, among the variables of mean ambient temperature in degrees Fahrenheit (X_1), body weight in ounces (X_2), and food consumption in grams per day ($\hat{Y}$), is expressed by the equation $\hat{Y} = 26.2 - .473X_1 + 1.57X_2$, which means that the food consumption per day decreased an average of 0.473 gram for every increase of 1 F in temperature and increased an average of 1.57 grams for every increase of 1 ounce in body weight. The multiple correlation coefficient for the three variables, R = 0.763, was significant. The partial correlation coefficient, ambient temperature and food consumption only, R = 0.613, was significant; and the partial correlation coefficient of food consumption with body weight only, R = 0.437, was significant. The predictability of food consumption was 58 percent if both body weight and temperature were known, 20 percent if body weight only was known, and 38 percent if temperature only was known. The relationship, for the penned rabbits, among the same variables, is expressed by the equation $\hat{Y} = 85.2 - .477X_1 + .929X_2$, which means that the food consumption per day decreased an average of 0.477 gram for every increase of 1 F in temperature and increased an average of 0.929 gram for every increase of 1 ounce in body weight. The multiple correlation coefficient, R = 0.531, was significant. The partial correlation coefficient, ambient temperature and food consumption only, R = 0.476, was significant; and the partial correlation coefficient of food consumption with body weight only, R = 0.241, was significant. The predictability of food consumption was 28 percent if both body weight and temperature were known, 6 percent if body weight only was known, and 23 percent if temperature only was known.

The greater correlation coefficients, and hence greater predictabilities, for the caged than for the penned rabbits, show that less of the variability was explainable for the penned than for the caged rabbits. Confinement in cages may restrict the opportunity for seasonal or individual differences in activity and may thus result in a more direct relationship between ambient temperature and energy consumption than occurs with animals in pens. The greater variability in food consumption by the rabbits in the pens may also have resulted from their ability to move about and seek a preferred microclimate within the pens, or even from the possible greater effect that changes in precipitation may have on the activity of rabbits in the open pens, as opposed to rabbits in the covered cages.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | November, 1971 | Vol. 14, No. 11

1. Pheasant Populations and Land Use — G. B. Joselyn

Hunting pressure on the Sibley Study Area during the opening weekend of the hunting season in 1971 was the lightest in recent years. However, those afield did very well, spending less time to bag a cock than in any of the preceding 9 years. The 125 hunters interviewed on the area this year during the opening weekend reported spending an average of 1.4 hours in the field to bag a cock, compared with 4.7 hours in 1970. Comparable figures for 1962 through 1969 were 2.2, 2.7, 2.1, 8.0, 6.9, 8.1, 5.0, and 4.3 hours, respectively.

The high success rate this year apparently resulted from two factors: the early completion of the corn harvest (and initiation of fall plowing) and the presence of a greater number of birds than had been indicated by estimates of late-summer population levels. Corn harvest on the study area and the attendant fall plowing had progressed further by opening weekend this year than in any year since 1964. The result was that pheasants were concentrated in unplowed corn stubble, making them more vulnerable to hunters than in most years. Standardized counts of pheasant broods on the study area during July and August 1971 recorded 23 percent fewer broods than in 1970 (MWRL 14(9): 1). This index therefore suggested a slight decrease in pheasant numbers in late summer, 1971, compared with 1970. However, almost all hunters reported seeing ample numbers of pheasants during the opening weekend, which, coupled with the high success rate, indicates that late-summer population levels may have been somewhat higher than suggested by the brood counts.

2. Manipulation of Pheasant Habitat — G. B. Joselyn

Because unmanaged control plots represent "typical" roadsides on the study area (in that their mowing is not controlled), differences in pheasant nest densities between this type of roadside and seeded plots are considered the best indicators of the response of pheasants to the seeding of roadsides.

For the 9 years 1963-71, pheasant nest density on seeded plots (2.7 nests per acre) was 2.2 times that on all (mowed and unmowed) unmanaged control plots (1.2 nests per acre). Nest density on seeded plots was 3.4 times that on mowed, unmanaged control plots (0.8 nest per acre), but was only about 1.4 times greater than the density on unmanaged control roadsides that were unmowed (2.0 nests per acre), thus indicating that merely leaving roadsides unmowed could result in meaningful benefits to nesting pheasants.

3. Ecology and Management of Squirrels — C. M. Nixon, R. E. Greenberg

Squirrel hunters that frequent public hunting areas for their sport are often relatively unskilled, compared with more dedicated squirrel hunters. A sample of 3,009 squirrel hunters were questioned concerning their hunting success during nine hunting seasons on one public hunting area. Nearly two-thirds, or 61.3 percent, killed no squirrels per hunter trip (one visit to the hunting area). For those killing one or more squirrels, 60.0 percent shot only one squirrel and only 16.9 percent killed more than two squirrels per hunting trip. Fall squirrel densities averaged 70 squirrels per 100 acres during the 9-year period.

Successful hunters, those shooting one or more squirrels per trip, averaged 4.0 hours per hunt; unsuccessful hunters averaged only 3.3 hours per trip.

The low success rate for these large numbers of unskilled hunters tends to reduce the squirrel harvest on public hunting areas from what might be expected on the basis of the number of hunters actually hunting on the area.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis

Prehunt censuses of quail were conducted on the Dale and Forbes areas in late October and early November, 1971. Weather conditions during this period--warm, dry, and frequently windy--were not conducive to locating quail with dogs. Coveys often flushed wild, and it was difficult to obtain complete counts of the coveys.

The fall population on Forbes in 1971 was 16 quail per 100 acres, a decline of 30 percent from the level of 23 quail per 100 acres in 1970. A similar decline was noted on the Dale Area in 1971. A population density of 22 quail per 100 acres was recorded, a decline of 40 percent from the 37 quail per 100 acres recorded in 1970.

It is doubtful that the population declines on both areas were as drastic as indicated by the censuses. However, our observations and those of park personnel suggest a lower prehunt population in 1970 than in 1971.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier, D. R. Vance

Prescribed burning has been carried out in either March or August on 166 plots, totaling 661 acres, during the past 4 years (1968-71) on sanctuaries at Bogota. The burned acreage consisted primarily of redtop, timothy, and fields in which prairie restoration is being attempted. A primary objective of burning is to learn whether fire can be a useful tool in maintaining the attractiveness of sanctuary grasslands for nesting hens. A total of 69 prairie chicken nests were found on the burned plots.

No nests have yet been found in 30 plots, totaling 125 acres, during the first nesting season after a March burn. Only two nests have been found in 133 acres (30 plots) during the first nesting season after an August burn. However, some excellent densities of nests have resulted after one full growing season

following prescribed burning in either March or August. Twenty-three nests have been found in 146 acres (36 plots) during the second nesting season after a March burn--a density of 6.3 acres per nest. Twenty-seven nests have been found in 118 acres (30 plots) during the second nesting season after an August burn--a density of 4.4 acres per nest. By the third nesting season after a March burn, only two nests were found in 74 acres (22 plots)--a density declining to 37.0 acres per nest. By the third nesting season after an August burn, however, a high density of 3.9 acres per nest was still evident (11 nests in 12 plots totaling 42.5 acres). Up to this point, the data suggest that burning in August is better than burning in March for maintaining attractive nesting cover for prairie chickens. Limited nesting is possible during the first nesting season after an August burn, in contrast to no nesting, and high densities have resulted in both the second and third nesting seasons after an August burn, instead of only the second season. Incongruously, in 1971, cover available for the fourth nesting season after a March burn produced the good density of 5.8 acres per nest--4 nests in 23.2 acres (6 plots). These later data preclude the emergence of a clear pattern. It is hoped that more data will provide a better basis for drawing conclusions on the longevity of the beneficial effects of prescribed burning on nesting prairie chickens.

6. <u>Rabbit Management</u> G. B. Rose

The annual fall censusing of cottontail rabbits on the 100-acre (40-hectare) study area at the 4-H Memorial Camp adjacent to Robert Allerton Park was conducted this year, the 16th successive year. One hundred and three rabbits were trapped and ear-tagged during a 10-day period at the beginning of November. Several population estimates were calculated from the capture and recapture data. The Schnabel (short form) estimate is 111 animals, the geometric maximum likelihood estimate (MLE-G) is 186, and the maximum likelihood estimate from a regression of the logarithm of the number of individuals in a frequency class on frequency of capture (MLE-R) is 164. The MLE-R is regarded as the best method of estimation.

On November 13, Dr. H. H. Shoemaker and students from the University of Illinois participated in the annual "rabbit drive" through the area to obtain an estimate of the ratio of color-marked to unmarked rabbits in the population. There were 33 observations of rabbits--24 were of yellow-tailed rabbits and 9 were of white-tailed rabbits. Hence, the Lincoln Index estimate was 120 rabbits, with 95 percent confidence limits of 94 to 146.

The MLE-R estimate of 164 rabbits is less than the November estimates of 211, 278, and 193, 1968 through 1970, but is comparable to the estimate of 176 for November 1967.

Incat.

Mr. Dodds

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

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Urbana, Illinois | December, 1971 | Vol. 14, No. 12

1. Pheasant Populations and Land Use

G. B. Joselyn

Over the past 10 years, 1962-71, estimates of numbers of pheasant hens per square mile on the Sibley Study Area in spring have ranged from a high of 95 in 1963 to a low of 26 in 1967. Thus, over the 4 years 1963-67, it was estimated that the density of hens per square mile on the study area in spring declined 73 percent. Slight recovery was noted in 1968 (28 hens per square mile). The recovery continued through 1971 (46 hens per square mile), making this estimate the highest since the estimate of 74 hens per square mile in 1964.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

For the 9 years 1963-71, density of pheasant nests on seeded roadsides (2.7 nests per acre) was more than double the density of nests on all (mowed and unmowed) unmanaged control roadsides (1.2 nests per acre), which are considered "typical" unseeded roadsides on the study area.

Density of successful (hatched) nests on seeded plots for the 9 years (0.8 successful nest per acre) was slightly more than double the density of successful nests on all unmanaged control plots (0.3 successful nest per acre). On mowed unmanaged control plots, for the 9 years, density of successful nests was 0.2 per acre, whereas on unmowed, unmanaged control plots, the success rate was 0.6 nest per acre. The density of successful nests on seeded plots ranged from 0.5 to 1.1 during the 9 years. The density on mowed, unmanaged control plots varied between 0.0 and 0.4 successful nest per acre during those years; unmowed, unmanaged control plots had from 0.4 to 1.1 successful nests per acre.

3. Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

During November 1971, a count of squirrel-built leaf nests and potential tree dens was conducted in a 70-acre, predominately pole-sized oak-hickory forest located in Vermilion County, Illinois

A total of 205 leaf nests were found and 104 (50.7 percent) were judged still serviceable. A total of 64 tree cavities (0.9 per acre) were found that could be used for nesting and for rearing litters. The total density of leaf nests and dens averaged 2.4 per acre.

The early-summer squirrel density for this same area was estimated at 1.7 squirrels per acre. The relatively low number of tree cavities means that many squirrels must occupy leaf nests or disperse from the study area.

A North Carolina study revealed that litters born in leaf nests experienced a higher average rate of mortality than litters reared in tree cavities. The low capture rate of first-litter young on this study area in late May 1971 may indicate a high incidence of litters born in leaf nests. There were only 2 spring-born young among 66 squirrels captured, yet 8 females that had recently nursed a spring-born litter were captured.

4. Responses of Bobwhites to Habitat Manipulation J. A. Ellis

From 1964 through 1971, 593 and 530 juvenile quail from Forbes and Dale, respectively, were aged by measuring the length of the last molted primary. These samples were from the first 7 days of the hunting season for each year. According to published charts on aging, nine percent of the juveniles from Dale were $\geq$150 days old when shot. Seventy-three percent of the sample of juvenile quail from Dale were between 101 and 149 days old. On Forbes, 10 percent of the sample of juveniles were $\geq$150 days old when shot and 63 percent were between 101 and 149 days old. The bulk of the juveniles harvested during the first week of the hunting seasons were hatched during the period from the third week of June to mid-August. There was no correlation between the prehunt densities and the various age cohorts in the populations.

(Erratum. The last sentence in November's No. 4 report should have read: However, our observations and those of park personnel suggest a lower prehunt population in 1971 than in 1970.)

5. Responses of Prairie Chickens to Habitat Manipulation. R. L. Westemeier, D. R. Vance

Prescribed burning is proving to be an effective and economical means of maintaining attractive nesting cover on sanctuaries for prairie chickens (MWRL 14(11):2). The highest densities of nests thus far recorded on the Bogota Study Area have been found in various types of grasslands after a burn in March or August. Burning in March appears better from the standpoints of encouraging the development of prairie vegetation and stimulating legumes, but burning in August appears better for such domestic sods as redtop and timothy, which have matured and are essentially dormant by August. Limited nesting has occurred during the first nesting season after an August burn, in contrast to no nesting after a March burn.

For the past 3 years (1969-71), the mean density was 4.2 acres per nest for cover in the second or third nesting seasons after August burns, and 40.5 percent of the August burn plots contained one or more nests. The mean density for March burns during the second, third, or fourth nesting season after burning was 8.4 acres per nest, with 29.7 percent of the March burn plots containing one or more nests. These densities for the burn plots exceed the density of 9.0 acres per nest for 759 acres that were unburned. The unburned acreage included sods in their second growing season or older.

Nesting hens, therefore, find the cover after an August burn more attractive than cover burned in March or unburned cover, but because prairie restoration is also a prime objective in the development of a sanctuary system, burning during March should continue.

6. Rabbit Management

G. B. Rose

The estimation of the respiration energy of animals in the field has proved to be a difficult problem for ecologists. Because it was impractical to attempt to determine the energy dynamics of free-living cottontails, it was decided to study mature rabbits held in 20- X 20-foot outdoor pens from which all vegetation had been eliminated and where energy intake could be determined from the amount of a known quantity of feed consumed (MWRL 13(2):4-5. When the energy intake and assimilation efficiency for the ration fed are known, the amount of energy assimilated can be estimated. (Note: Growth energy should also be accounted for--but it is near zero in adult animals.)

The food consumption by the penned cottontails is expressed by the equation $\hat{Y}=85.2-.477X_1+.929X_2$, when X_1 is ambient temperature in degrees Fahrenheit, X_2 is body weight in ounces, and Y is food consumed, in grams (MWRL 14(10):4).

Using the above equation, when ambient temperature equals 28 C and body weight equals 40 ounces, $\hat{Y}=83$ grams of food consumed per day. Since the digestible energy in a gram of rabbit chow is approximately 2.5 kcal/gram, 83 grams of food is equivalent to a metabolism of 207 kcal per day.

In an earlier study, the basal metabolism of adult domestic rabbits, ranging in weight from 1 kilogram to 7 kilograms, was measured at temperatures in the thermoneutral zone for domestic rabbits, 28 C to 32 C. It was found that the linear equation $h_{total} = 39.35W+22.5$, when h_{total} is total kilogram calories of heat produced (i.e., respiration) per 24 hours and W is body weight in kilograms. When rabbit body weight is 40 ounces, then, the estimated basal metabolism is 67.1 kcal per day.

Thus, the metabolism of the penned cottontails was 3.09 times the basal metabolism of a domestic rabbit of the same weight. Hence, the metabolism of free-ranging cottontails should be at least three times the basal metabolism of domestic rabbits of the same weight.

Whether the metabolism of free-ranging rabbits exceeds that of penned cottontails is not known. Possibly it does not, for metabolism of cotton rats in the field was found to be only 3 to 11 percent greater than (and not significantly different from) that of cotton rats in the laboratory, and the metabolism of penned rabbits was already 56 percent greater (at one temperature) than the metabolism of caged rabbits.

If the metabolism of free-ranging rabbits exceeds that of rabbits in outdoor pens, it is for one or both of two possible reasons. First, there could be a greater expenditure of energy for a free-ranging rabbit to search for, find, and eat suitable food plants than for a penned rabbit to go to the food dish and eat from it. However, because of the common occurrence of plants eaten by rabbits, it seems unlikely that the energy cost of the two activities would differ greatly. Second, there could be increased energy costs, to free-ranging rabbits, resulting from interaction with other individuals of the same

or different species. Such interactions might include courtship or fighting between individuals of the same species, or fleeing from possible predators. The energy costs of these activities are unknown, but such exertions are probably infrequent enough and of short enough duration to increase only slightly the metabolism of free-ranging cottontails over that of penned ones.

Incat.

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois January, 1972 Vol. 15, No. 1

1. Pheasant Populations and Land Use

G. B. Joselyn

Plowed ground is generally recognized to be of little value to pheasants during the winter months, whereas corn stubble left over the winter may provide at least a degree of cover and some source of food. As the size of farms and the acreage of row crops (corn and soybeans) increase in the intensively farmed cash-grain region of east-central Illinois, the amount of fall plowing might be expected to show a corresponding rise. Thus, with more land under cultivation per individual farmer, most operators find it desirable to plow as much as possible in the fall to prepare fields for planting during the following spring. Among other benefits, fall plowing provides a hedge against the occasional wet spring, when delays in planting could be costly in terms of lower crop yields.

However, the level of fall plowing on the 32,200-acre Sibley Study Area has not changed materially over the past 9 years. In 1962 (when 64 percent of the area was planted in corn and soybeans), 51 percent of the area was fall-plowed; in 1970 (83 percent of the area in corn and soybeans), 56 percent of the area was plowed in the fall. During the 9-year period, the dry fall of 1964 resulted in the most fall plowing (63 percent); in contrast, the wet fall of 1967 allowed only 12 percent of the area to be plowed. However, the acreage of corn and soybeans planted in 1968 appeared little affected by the low level of fall plowing the preceding year.

Therefore, the substantial increases in the acreages of row crops over the past 9 years have not been followed by corresponding increases in fall plowing in the Sibley Study Area. Although farm operators might wish to fall-plow most of the land to be cultivated during the following spring, the upper level of plowing intensity is evidently about 65 percent of the land area, the proportion each year being a function of moisture conditions during and after harvest and the date when frozen ground precludes further field work.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

For large-scale roadside seeding programs to be successful, cooperating farm operators must refrain from mowing their roadsides until about July 31. Widespread mowing much before this date would greatly diminish the value of seeded roadsides as nesting cover for pheasants. Whether most farm

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operators on the FCMU would delay the mowing of their roadsides (as agreed) until the date specified was a primary aspect of the program on that area. Frequent mowing of roadsides by farmers, beginning in June, is typical practice throughout much of central Illinois; in this area, it is uncommon to find a roadside that is unmowed on July 31. Thus, for farmers on the FCMU to refrain from mowing until the date requested by Department biologists constitutes a departure from past practices.

During the summer of 1967, before the farmers on the FCMU had been contacted, checks were made on the progress of mowing operations on the study area. Nearly 60 percent of the roadsides had been mowed by June 15 and nearly 90 percent by July 15.

Last summer (1971), as in 1970, cooperating farmers on the FCMU generally adhered to the delayed mowing agreement, although there was a slight increase in the percentage of roadsides mowed. In 1970, about 10 percent of the roadsides of cooperating farmers had been mowed by July 31; about 14 percent were mowed by that date in 1971. These percentages contrast with 97 percent of the roadsides mowed by this date in 1967. By August 15, 1970, about 60 percent of the roadsides had been mowed, and by this date last summer 68 percent had been mowed, compared with nearly 100 percent on this same date in 1967.

3. Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

A total of 72 squirrel-hunter cooperators returned usable hunting-report booklets for the 1971 hunting season. This total represents a 37.5 percent return after one follow-up reminder to return the booklet.

Cooperators were requested to provide information concerning each squirrel hunt, including the number of hours hunted, the county hunted, the number and species of squirrels killed, and the breeding status of female squirrels. Hunters were asked to note whether each female was pregnant or nursing when killed. For each pregnant female, the hunters were asked to count and report the number of unborn embryos.

Data collected from the hunter cooperators will be analyzed for distribution of hunting pressure, sex and age of squirrels killed, number of pregnant and nursing females killed, and average litter size for each species.

Each of these parameters will be examined at biweekly periods, beginning August 1, to determine the effects of the time of hunt on these data.

A total list of 500 cooperators is anticipated for the hunting seasons of 1972 and 1973.

4. Responses of Bobwhites to Habitat Manipulation — J. A. Ellis

For 8 years the mean numbers of bobwhite calls recorded per listening stop along standardized audio-census routes on the Forbes and Dale areas have been correlated with the subsequent prehunt densities (Forbes $P < 0.005$, Dale $P < 0.025$). The mean numbers of whistling cocks per listening stop were also significantly correlated with the prehunt densities on Forbes ($P < 0.025$) but not with those on Dale. It is difficult to identify more than seven individual whistling cocks in 2 minutes at a stop during the period of peak whistling activity, but it is relatively easy to count the total number of bobwhite calls. Frequently, during the weekly audio-censuses on Dale, more than seven cocks are heard (the exact number unknown) per stop; these are recorded as seven-plus cocks, along with the total number of calls. Such situations are not as common on the Forbes Area. The quail densities in spring on Dale have always been higher than on Forbes and compare favorably with those on areas of high quail densities in southern Illinois. In relating audio-censuses to subsequent fall and harvest levels of quail in areas of high densities, the number of bobwhite calls has provided a more accurate estimate than the number of whistling males.

5. Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier, D. R. Vance

During the period of 1963-71 at Bogota, the distances from 240 prairie chicken nests to the estimated centers of the nearest booming grounds have ranged from 72 yards to 2,640 yards, with respective mean, mode, and median distances of 349 ± 15 (SE) yards, about 235 yards, and about 380 yards. These data indicate that few nests occur within 100 yards of, or farther than 600 yards from, the centers of booming grounds. Eighty-one percent of the nests were between 100 and 450 yards from the nearest booming ground.

The mean distance of 62 nests from the estimated centers of seven booming grounds completely surrounded by nesting cover was 253 yards. In these instances, the nests tended to encircle the booming grounds in radial patterns.

The number of cocks on the booming grounds has ranged from single cocks up to 54 cocks since 1963. It can be hypothesized that the distance that hens nest from the booming grounds increases with an increase in the number of cocks on the booming grounds. However, a correlation analysis between the distances from nests to booming grounds and the number of cocks failed to reveal a significant relationship ($r = 0.123$). Apparently, larger booming grounds have no more influence on nest distribution than do smaller grounds.

6. Rabbit Management

The rabbit project has been terminated as of January 1972.

Treat,

Mrs. Dodds

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | February, 1972 | Vol. 15, No. 2

1. Pheasant Populations and Land Use

G. B. Joselyn

The preceding report (MWRL 15(1):1) pointed out that substantial increases in the acreage of row crops on the Sibley Study Area over the past 9 years have not been followed by corresponding increases in the proportion of the area that is fall-plowed. Thus, although farm operators might wish to fall-plow most of the land to be cultivated during the following spring, the upper limit of plowing is evidently about 65 percent of the land area, the proportion each year being a function of moisture conditions during and after harvest and the date when frozen ground precludes further field work.

Although pheasants are known to roost in corn stubble (particularly during periods of deep snow), it is also evident that in the absence of appreciable snow cover, hay and oats of good quality are preferred roosting cover. Over the past 10 years, the acreage of overwintering hay and oats stubble on the study area has declined steadily. During the winter of 1962-63, 3,242 acres of hay and oats existed on the study area; during the winter of 1970-71, only 701 acres of hay and oats overwintered (a decline of 77 percent). Although the implications, for pheasant survival, of this relative scarcity of hay and oats during winter are unknown, the continued decline of this cover each year since 1963 reflects the general decline in forage crops on the area.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

Data collected from the Sibley Study Area between 1963 and 1971 show that on a per-acre basis, managed seeded roadsides produced about three times the number of successful pheasant nests as unmanaged roadsides. It is therefore reasonable to infer that seedings over a large area could nearly triple pheasant production on roadsides. However, the question of whether seedings over a sizable area would have sufficient impact on the pheasant population to justify the cost of the seedings remains unanswered. In evaluating the potential of managed seeded roadsides as a management tool, the question is to what extent they could be expected to supplement other production--not whether they could by themselves produce enough birds to insure a huntable population.

At the beginning of this research project in 1962, 9.4 percent of the land on the Sibley Study Area was in hay; by 1971 this percentage had dwindled to 2.1 percent, with indications of further decreases in the

future. Thus, it is possible that roadsides, only 1.3 percent of the study area, will constitute the largest segment of potential nesting cover for pheasants within a few years.

In 1970, the 149.2 acres of managed seeded roadsides increased the amount of land in hay on the Ford County Management Unit (FCMU) from 402 to 551.2 acres, an increase of 37.1 percent. (At the same time, however, the amount of unseeded roadside cover on the area was reduced by over 90 percent.) In 1971, seeded roadsides increased the total hay acreage on the area from 310 to 459 acres (a 48 percent increase). Thus, the contribution of seedings to the total hay acreage increased 11 percent over the 2 years. If the proportion of the total land area in hay continues to decline on the FCMU, the contribution of the managed seeded roadsides to the total acreage in hay will increase. If, eventually, the acreage in hay on farms makes up only one percent of the land area on the FCMU (102 acres), the 149.2 acres of seeded roadsides will increase the total hay acreage by over 146 percent. Admittedly, increasing 402 acres of hay by 37 percent, or 102 acres by 146 percent, provides only a small amount of hay for an area of this size. Nevertheless, under such circumstances, the contribution of seeded roadsides to the nesting-cover complex could be substantial.

3. Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

As part of a comprehensive study of gray squirrel habitat in Illinois, the proportion of the total squirrel harvest, in each county, that was composed of gray squirrels during the hunting seasons of 1956 and 1957 was compared with the percentage of each county in forest in 1962. A significant positive correlation ($r = +0.82$; $P < 0.01$) was found using the proportion of gray squirrels in the squirrel kill for each county as the dependent variable (Y) and the percentage of forest cover in the county as the independent variable (X). The best fit for the regression of (Y) on (X) was linear, expressed by the equation $\hat{Y} = 4.11 + 1.53X$.

Using this equation as a predictor for (Y) indicates that each 10 percent increase in the forest cover in a county increases by about 15 percent the proportion of gray squirrels in the squirrel kill of the county. A county must be 30 percent forested to attain a kill composed 50 percent of gray squirrels.

In spring 1972, a resurvey of the county distribution of gray squirrels harvested during the hunting season of 1971 will be undertaken to determine whether significant changes in distribution of gray squirrels have occurred since 1956 and 1957.

4. Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

Harvest data collected during the hunting season in 1971 revealed a slightly higher kill on the Forbes Area than in 1970. A kill of 9.4 quail

per 100 acres was recorded on Forbes in 1971, an increase of 25 percent over the kill in 1970. The harvest in 1971 was 60 percent less than the peak harvest of 23.4 quail per 100 acres recorded in 1968.

The harvest on Dale in 1971, 16.5 quail per 100 acres, was 18 percent less than the kill recorded in 1970, and 50 percent less than the peak harvest of 32.2 quail per 100 acres recorded in 1969.

The harvests in 1971 represented 58 percent and 75 percent of the estimated prehunt populations on Forbes and Dale, respectively. The long-term mean rate of exploitation was 62 percent of the prehunt populations for Forbes and 69 percent of the prehunt populations for Dale.

5. <u>Responses of Prairie Chickens to Habitat Manipulation</u> R. L. Westemeier, D. R. Vance

The sanctuary system for prairie chickens has expanded from 77 acres acquired in 1962 to the present acreage of 1,322 acres. These sanctuaries include 11 acquisitions totaling 862 acres near Bogota in Jasper County and 4 acquisitions totaling 460 acres in Marion County near Kinmundy and Farina. The acquisitions were initially made by the Prairie Chicken Foundation of Illinois (297 acres) and the Prairie Grouse Committee (PGC) of the Illinois Chapter - The Nature Conservancy (1,025 acres). During the summer of 1970, the Illinois Department of Conservation, acting through the Illinois Nature Preserves Commission, acquired five sanctuaries totaling 410 acres from the PGC. The PGC is using monies received for these lands to purchase additional sanctuaries. Currently, negotiations are being made for the PGC to purchase three additional tracts at Bogota, totaling 180 acres. Also, in Marion County, three tracts of 80 acres each are being considered for purchase. One tract of 12 acres, containing a farmstead near the village of Bogota, is to be sold off the 175-acre Fuson Farm. Thus, if all these negotiations are successful, the sanctuary system will total 1,030 acres in Jasper County and 700 acres in Marion County. The long-term goals of land acquisition call for a 1,500-acre sanctuary system in both Jasper and Marion counties.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois March, 1972 Vol. 15, No. 3

1. Pheasant Populations and Land Use

This project was terminated, because of the lack of a project leader, as of September 1971, although residual reports have continued to appear in the *Research Letter*. From now on, reports will appear only when pertinent data are available.

2. Manipulation of Pheasant Habitat

G. B. Joselyn

Establishment of the Ford County Management Unit (FCMU) as a pilot roadside management program has several distinct and well-defined goals. One goal is to evaluate various aspects of the maintenance of seeded roadsides where farmers are responsible for such upkeep.

The primary role of the Department of Conservation in this regard has been the placement and maintenance of signs at the 16 entrances to the FCMU to inform motorists why roadsides remain unmowed throughout most of the summer. It has been determined from comments by farmers that, in their view, the present signs need to be enlarged and additional ones placed in order to serve their intended purpose. These changes are expected to take place during early May.

Cooperating farmers on the FCMU have been requested to mow portions of roadsides, at their discretion, around lane and field entrances to provide a clear view of oncoming traffic. The extent to which discretionary mowing is being carried out and the potential safety problems associated with the lack of such mowing are being studied. We are also attempting to deal with the problem arising from farmers moving onto the area who were not involved in the original agreement to allow seedings and to delay mowing.

It is expected that, as the seedings mature, other questions will arise that could have a direct bearing on the approach to similar operations in other areas.

3. Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

In central Illinois, most leaf nests built during the late-summer or fall months disintegrate during the winter. Squirrels are then forced to

move to tree cavities, to disperse from the area, or to construct new "twig nests" better able to withstand high wind velocities.

Information collected from one 70-acre oak-hickory stand, with less than one nest cavity available per acre, suggests that dispersal is the usual recourse after nest destruction in winter, particularly for juvenile squirrels. A total of 205 leaf nests were counted on this area in November 1971. In late February 1972, only 28 nests, 13.6 percent of the November total, were judged still suitable for occupancy by squirrels. Livetrapping undertaken in late February on this same area showed that juveniles (<12 months of age) were present in very low numbers. Yet reproduction on the area was normal for the summer breeding period of 1971, based on an examination of females livetrapped in October 1971. A lack of suitable nests and tree dens, or both, for the juveniles produced in 1971 probably caused them to disperse from the study area. This area is not hunted and appears to contain a stable, mostly adult, population of fox squirrels.

4. <u>Responses of Bobwhites to Habitat Manipulation</u> J. A. Ellis

Harvest data from the Forbes and Dale areas for 1971 revealed kills of 16 (Dale) and 9 (Forbes) quail per 100 acres. The harvest at Forbes in 1971 was 25 percent greater than in 1970, whereas the harvest on Dale was 18 percent lower. The harvests for both areas in 1971 were considerably lower than the long-term means (Dale, 23 quail per 100 acres; Forbes, 13 quail per 100 acres). Kills per hunter trip in 1971 were 0.7 for Forbes and 0.8 for Dale, compared with the long-term means of 1.0 (Forbes) and 1.1 (Dale).

Hunting effort on both areas in 1971, 49 and 67 gun-hours per 100 acres for Forbes and Dale, respectively, were slightly higher than the long-term means for the areas (Forbes, 46 gun-hours and Dale, 64 gun-hours, per 100 acres). Gun-hours per kill averaged 4.0 for Dale and 5.0 for Forbes, compared with the long-term means of 3.5 gun-hours per kill (Forbes) and 2.8 gun-hours per kill (Dale).

5. <u>Response of Prairie Chickens to Habitat Manipulation</u> R. L. Westemeier, D. R. Vance

The most feasible approach to the management of prairie chicken sanctuaries, which has been successfully employed to date, involves five principal needs. These needs include: (1) annual grassland management, (2) sharecropping, (3) an economic return or profits, (4) maintenance of soil fertility, and (5) the payment of real estate taxes. The necessary annual management of sanctuary grasslands has been accomplished by sharing agreements with local farmers to do the following: combine grass and legume seed, mow hay, mow for weed and brush control, graze, plow, disk, and make seedings. The sharecropping often results in a moderate profit to both the cooperating farmer and the Prairie Chicken Foundation of Illinois (PCFI) or the Prairie Grouse Committee of the Illinois Chapter - The Nature Conservancy (PGC). The maintenance of at least moderate levels of soil fertility is essential for economic return, which, in turn, is a requisite for buying

limestone and fertilizer. An additional benefit derived from an economic return is that it makes possible the payment of taxes on the sanctuary lands, and, consequently, good public relations are maintained. These factors are all essential and interrelated principles of the sanctuary management that is producing favorable responses by the prairie chickens in both Jasper and Marion counties. It is hoped that these basic principles can also be incorporated into the management of state-owned sanctuaries.

Incat.

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | April, 1972 | Vol. 15, No. 4

Manipulation of Pheasant Habitat

G. B. Joselyn

For the 9-year period of 1963-71, 447 pheasant nests were located on seeded roadside plots and 302 nests on managed control plots. The rates of nest success on the two types of roadsides were virtually the same for the period. On seeded plots, 125 (28 percent) of the established nests hatched; on managed control plots, 82 (27 percent) of the nests hatched.

Success rates among years have varied considerably on both types of roadsides. On seeded plots, the range was from 19 percent (1971) to 42 percent (1968); on managed control plots, the range was from 13 percent (1964) to 42 percent (1969).

Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

One of the most important aspects of squirrel management is the timing of the hunting season in relation to the reproductive cycle. The squirrel hunting season in southern Illinois traditionally opens on August 1, when many adult females are pregnant or are nursing young. These females in the hunter's bag represent the loss of unborn young and of baby squirrels that die of starvation.

Data derived from 2,726 squirrels bagged in the Southern Zone during the squirrel hunting season of 1971 indicate that about 17 percent of the adult females shot were pregnant or nursing. The proportion of adult females that were pregnant or nursing was high during August and peaked at approximately 27 percent during August 16-31. Reproductive activity declined sharply after August 31. Less than 13 percent of the adult females shot during September 1-15 were pregnant or lactating, and the proportion was below 15 percent for the remainder of the hunting season. There were no pregnant or lactating females in our sample of 112 squirrels bagged November 1-15.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

Some investigators of quail ecology reported that whistling cocks in summer represented surplus (nonmated) males. Audio-census data from the Forbes and Dale areas, and from workers in Alabama and Wisconsin, suggested that both mated and unmated cocks whistle during June and early July. Our observations of

cock-hen pairs along the audio-census routes near the listening stops indicated that these paired males, accompanied by their mates, did not whistle. It was believed that the majority of cocks whistling during the period from late May to mid-July were those whose mates were tending nests--probably incubating. This contention was supported by data obtained from juveniles (ages determined by wing molt) in the harvests. The bulk of the juveniles harvested during the first 7 days of each hunting season were from nests that were incubated from the first week of June to the third week of July.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

As in the past nine springs, booming ground surveys were conducted this spring (1972) on the Bogota Study Area at no less than weekly intervals from mid-March through mid-April. These data were supplemented by observations recorded almost daily by visitors in blinds on several booming grounds. Counts were made during the first 1.5 hours after daybreak, and an effort was made to determine the maximum number of cocks on the area.

The peak count of 196 cocks at Bogota this spring was 23 percent higher than the peak count in the spring of 1971 and represents the fourth consecutive increase in the Bogota flocks(s). The count this spring is 151 percent higher than the count made in 1963, when this census was initiated, and 430 percent higher than the low count of 1968.

Except for two minor booming grounds involving only one or two cocks each, all booming was located on or within 200 yards of the sanctuaries. The traditional central core of the Bogota Area contained the phenomenal density of 135 cocks--a half-section area containing the Ralph E. Yeatter, Marshall Field III, and Max McGraw sanctuaries (232 acres). Between the springs of 1971 and 1972, the counts on the Otis and Fuson Farm sanctuary on the west edge of the area increased by 50 percent and the counts on the Mark sanctuaries on the northeast corner of the study area increased 57 percent. For the first time since its acquisition in 1965, one cock was present regularly on the 80-acre Jamerson McCormack Sanctuary on the extreme south edge of the area. One morning four hens were seen with this vanguard.

Uncat.

Dr Sprugel

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | May, 1972 | Vol. 15, No. 5

Pheasant Populations and Land Use

G. B. Joselyn

During the period April 17 to May 2, 1972, systematic counts of pheasants were conducted along 57 miles of all-weather roads on the Sibley Study Area. Observations were confined to only one side of the road along the 16 miles of these roads that border the study area. As in the past 3 years, the observation period was confined to the first 2 hours after sunrise, which allowed coverage of half the roads each morning. Four counts were obtained for each road.

These counts revealed 37 percent fewer cocks in 1972 than in 1971, and 8 percent fewer than in 1970. The counts in 1972 recorded 204 cocks (105 per 100 miles), compared with 325 cocks (168 per 100 miles) in 1971 and 222 cocks (114 per 100 miles) in 1970. Winter sex ratios obtained during periods of snow cover during January and February, 1972, were 26 cocks per 100 hens; sex ratios of 40 and 37 cocks per 100 hens were obtained during the winters of 1970 and 1971, respectively. By using these figures, hen indices for 1970 were calculated at 555; for 1971, 878; and for 1972, 785. The hen index for 1972 is therefore estimated at about 10 percent less than the index for 1971 but 41 percent higher than that of 1970.

While the spring hen population in 1972 appears to be down slightly from 1971, it still is estimated to be higher than in any year (except 1971) since 1964. During that year, the hen index was 1,420; the indices for 1963 and 1962 were 1,822 and 1,720, respectively. The lowest index during the last 11 years was 491 hens in 1967.

Manipulation of Pheasant Habitat

G. B. Joselyn

Efforts of the Department of Conservation to seed graded roadsides throughout Ford County were described in earlier reports (MWRL 14(6, 7):1-2, and MWRL 14(8):1). Road maintenance personnel (county and township) make it a practice, each year, to grade the roadsides adjacent to those roads scheduled to be blacktopped. In Ford County, grading was done along approximately 64.5 miles of roads (both sides) during 1970 and 1971, the equivalent of roadsides around 16 square miles. Indications are that each year, for 10 years, grading will be done along approximately 20 miles of road in the county. Since graded roadsides are not reseeded by the township or county, these areas are virtually devoid of nesting cover for several years after grading. It is therefore considered desirable to attempt cover restoration on these roadsides on a continuing basis.

Of 130 farm operators whose lands are adjacent to the 64.5 miles of graded roadside, 120 (92 percent) agreed, when contacted by Department biologists, to allow the Department to seed their roadsides, and to refrain from mowing until on or after July 31 each year after the seedings mature. Plans were made to seed these roadsides during August and September 1971, but the late arrival of seed precluded the seeding operation at that time. Wet weather during March and April of this year has further delayed the seedings, which are now scheduled for this coming August and September.

Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

Hunter satisfaction with the squirrel season depends largely on hunter success in bagging squirrels--especially during the opening weekend, when hunting pressure is highest.

Our sample of 59 avid squirrel hunters in the Southern Zone averaged 2.93 squirrels killed per hunter trip during the hunting season of 1971. Hunting success was lowest during the opening 2 weeks of the season (2.49 squirrels killed per trip), despite heavy hunting pressure, probably because squirrels are difficult to find in heavy summer foliage until they begin "cutting" seed crops about mid-August. Hunter success increased sharply during the last half of August (3.00 squirrels killed per hunter trip) and maintained a high level (2.91 or more) throughout the rest of the season. The highest success rate (3.43 squirrels killed per hunter trip) was attained during the October 16-31 period, at a time when seed crops had fallen from the trees and squirrels were actively foraging for and caching seed.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

Censuses of quail were made on the Forbes and Dale areas in early January to obtain estimates of the posthunt population densities. Fifteen coveys, 151 quail (6.2 quail per 100 acres), were observed on Forbes. The posthunt estimate for Forbes in 1972 was 14 percent lower than was recorded in 1971 and was also 14 percent lower than the long-term mean for the posthunt estimates. The posthunt estimate for 1972 represented a decline of 61 percent from the estimated prehunt population in 1971.

Eleven coveys containing 120 birds (10.9 quail per 100 acres) were observed on Dale during the posthunt census in 1972. The posthunt estimate in 1972 was 24 percent lower than that of 1971 and 17 percent less than the long-term mean for the posthunt population. The quail population on Dale declined 60 percent from early November to January. On both areas, harvests accounted for more than 90 percent of the population losses from November to January.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Results of booming ground surveys conducted in nine areas in seven counties of south-central Illinois in the spring of 1972 revealed a total of 261 prairie chicken cocks. The 196 cocks in the Bogota flock comprised 75 percent of the known statewide total and showed an increase of 23 percent since the spring of 1971 (MWRL 15(4):2). Flocks in the Farina and Kinmundy-Forbes Park areas have regained last year's losses and now contain 28 cocks and 12 cocks, respectively. Of the six areas outlying the two sanctuary systems, only the Hoyleton flock showed an increase (2 cocks to 5 cocks). No prairie chickens were seen in the LaClede area, where 1 cock remained last spring. Other declines included Loogootee (8 cocks to 6 cocks), Fairman (4 cocks to 3 cocks), and Mt. Erie (13 cocks to 6 cocks). Five cocks were again censused near Bible Grove. Flocks on the sanctuary systems in Jasper and Marion counties accounted for 47 of the 50 additional cocks found since the spring of 1971. All declines occurred on unmanaged areas.

The two flocks in northeastern Marion County are now firmly bound to nesting sanctuaries. Major shifts in distribution were noted as cocks abandoned traditional booming grounds and established new grounds on, and in proximity to, the 100-acre Lacey Sanctuary and adjacent Loy 40-acre tract near Farina and also near the 160-acre Butler Sanctuary between Kinmundy and Forbes State Park. These encouraging responses give hope for the preservation of prairie chicken flocks in Marion County as well as in Jasper County.

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Doris Dodds

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois June, 1972 Vol. 15, No. 6

Manipulation of Pheasant Habitat

G. B. Joselyn

One of the primary reasons for the establishment of the Ford County Management Unit (FCMU) was to determine to what extent farm operators would adhere to the verbal agreement to delay the mowing of their seeded roadsides until on or after July 31 each summer. In the spring after the seedings matured (1970) and in 1971, cooperating farmers on the FCMU were sent letters in May requesting them not to mow their roadsides, as agreed, until July 31. However, since a large-scale roadside management program would entail contacting hundreds of farmers each spring, an annual notice to request compliance with the nonmowing agreement would be impractical. Therefore, the cooperating farmers were notified in the 1971 letter that no follow-up letters would be sent in subsequent springs but that continued cooperation in delaying mowing would be appreciated. Whether the farmers would continue to delay mowing--as in the previous 2 years--without being reminded was unknown.

A check of cooperator roadsides on June 16 this year revealed little change in the amount of seeded roadsides that had been mowed, as compared with the amount mowed by the same date last year. This year, as in 1970 and 1971, approximately 7 percent of cooperator roadsides had been mowed by mid-June. Data from the past 2 years indicate that most of the mowing that occurs on seeded roadsides prior to July 31 is done by mid-June. We are therefore hopeful that compliance with the nonmowing agreement will continue through July.

Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

Our sample of 59 cooperating avid squirrel hunters in the Southern Zone went squirrel hunting a total of 931 times during the hunting season of 1971. This total represents approximately 2,464.5 man-hours of recreation. Hunting pressure was highest during the first 2 weeks of the season (August 1-15), when our cooperators spent 704.5 man-hours in the field. This figure represents 28.6 percent of their total hours afield for the entire 14-week season. During the second 2 weeks of August, hunting pressure dropped considerably (35.5 percent less than during the first 2 weeks), and it continued to decline slowly (from 15 to 10 percent of the total hours afield) through the first 2 weeks of October. During the period October 16-31, there was a modest increase in hunting pressure (15.9 percent greater than

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during the preceding 2-week period). This increased pressure was probably related to increased hunter success (MWRL 15(5):2), as the leaves were falling and squirrels were on the ground foraging for nuts. Hunting pressure was low (only 3.8 percent of the total hours afield) during the last 2 weeks of the season (November 1-15).

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

Analyses of population and audio-census data for Forbes and Dale for the period 1964-72 revealed some interesting relationships. A significant correlation existed between the prebreeding populations and the mean numbers of calls per stop for Dale (r = +0.830, $P < 0.05$) but not for Forbes (r = +0.612, $P > 0.05$). Also, the prebreeding populations on Dale were significantly correlated ($P < 0.10$) with the prehunt populations. On Forbes, the relationship between the prebreeding populations and the prehunt populations approached, but did not reach, significance (F = 3.73; ref. F = 3.78, 6 df). The population densities of quail on lands surrounding the study areas were believed to have influenced the dispersions of the populations from the time of the prebreeding censuses to the period of the audio-censuses. During the breeding seasons, the numbers of quail on the lands surrounding the Dale Area probably approached, if not equaled, the numbers of quail on the study area. Movements by quail on and off the Dale Area would tend to be equal. At Forbes, movement by bobwhites would tend to be away from the study area.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemier,
D. R. Vance

During the spring of 1972, 301 people visited the prairie chicken sanctuaries in Jasper County on a reservation basis. In addition, an unknown number of people without reservations visited the sanctuaries. Forty-five groups and 29 mornings were involved this spring. Groups represented included the following: Earlham College, 57 individuals; Illinois Department of Conservation, 13; Northern Illinois University, 11; Illinois Audubon Society, 23; Illinois Natural History Survey, 13; Illinois State Museum, 2; Goshen College, 8; Illinois State University, 4; Greenville College, 8; University High School, 15; Purdue Bird Study Group, 4; Ohio Audubon Council, 11; University of Illinois, 23; Eastern Illinois University, 15; Musselman Audubon Society, 13; Indiana University, 14; CBS TV News, 1; Champaign Centennial High School, 20; Boy Scouts of America, 9; and 37 other interested ornithologists, sportsmen, and laymen. Included in these groups were visitors from Indiana, Ohio, Tennessee, Maryland, and California. Thus, prairie chickens in Illinois continue to provide a unique nature experience and an educational opportunity for people throughout the nation as well as for the people of the Prairie State.

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Mrs Doris Dodds, Librarian

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois — July, 1972 — Vol. 15, No. 7

Manipulation of Pheasant Habitat

G. B. Joselyn

In 1972, the first search for pheasant nests on seeded and on managed control plots along 8 miles of roadway on and near the Sibley Study Area was conducted during the period June 22-27. Forty-seven nests were located on the plots, 30 on seeded and 17 on managed control plots. These totals represent declines in nest abundance of approximately 35 percent on seeded plots and approximately 45 percent on managed control plots, compared with the totals for the first search in 1971 on the same 8 miles of roadway--46 nests on seeded plots and 31 nests on managed control plots.

Table 1. Results of first nest searches on seeded and on managed control plots, Sibley Study Area, 1963-72.

Year	Miles of Roadway	Number of Nests: Seeded Plots	Managed Control Plots	Total
1963	7.0	40	40	80
1964	8.0	52	33	85
1965	9.0	35	22	57
1966	10.5	44	26	70
1967	9.5	30	22	52
1968	9.5	36	23	59
1969	9.5	22	16	38
1970	9.5	37	23	60
1971	8.0	46	31	77
1972	8.0	30	17	47

Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

During the 14 squirrel-hunting seasons from 1956 through 1969, which we shall use as our long-term base, the number of squirrels bagged by Illinois hunters averaged 2.83 million per year. A high of 3.64 million squirrels in the bag was recorded in 1957, and a low of 2.37 million occurred in 1965 (Illinois Dept. Conserv. Tech. Bull. 4, 1971).

The Southern Conservation Zone, here defined as the 51 southernmost counties in the state, accounted for a mean kill of 1.68 million squirrels per year (59.3 percent of the statewide harvest) during the base period of 1956-69. Hunting pressure in the Southern Zone was also high, despite the fact that 85 percent of the state's 11.1 million people reside in the Northern Zone (here defined as the 51 northernmost counties). Illinois squirrel hunters averaged 1.41 million hunter-trips per year, 1956-69, 54.7 percent of them in the Southern Zone. Hunter success was notably higher in the Southern Zone (an average of 2.18 squirrels reported bagged per hunter-trip) than in the Northern (an average of only 1.80 squirrels per hunter-trip). Randolph and St. Clair counties ranked 1 and 2, respectively, in both squirrel harvest and hunting pressure during the 14-year period.

The gray squirrel accounted for most of the difference in harvest between the two zones during 1956 and 1957, when the harvest data were collected by species. The statewide kill of fox squirrels for the 2 years, estimated at 4.69 million, was nearly equally divided between the zones (49.6 percent in the Southern Zone, 50.4 percent in the Northern Zone). The kill of gray squirrels, estimated at 1.64 million, was unevenly distributed, with 79.6 percent of the harvest occurring in the Southern Zone.

The comparative relationship between the two Conservation Zones, in terms of squirrel hunting, is probably the result of differences in the amount of forest and abundance of squirrels--differences that modify or stimulate hunter interest in squirrels as game animals.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

The mean numbers of bobwhite calls recorded per stop along standardized routes on the Forbes and Dale areas have been used as indices of fall population densities (MWRL 12(9):2) on these areas. Analysis of data for 1964-71 showed significant regressions ($\underline{P} < 0.005$) between the numbers of bobwhite calls per listening stop and the fall population estimates obtained by censuses with bird dogs. Predicted population levels for fall 1972, based on these regression formulae, are 41.6 and 21.8 quail per 100 acres for Dale and Forbes, respectively. These estimated densities for 1972 represent an 11 percent increase in the prehunt denisty on Dale and a 10 percent decrease in the prehunt density on Forbes, compared with the estimates made in 1971.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Prescribed burning in March or August is proving to be beneficial in the rejuvenation of redtop and timothy sods, as nest densities up to one nest per 0.8 acre were found in some plots at Bogota during the second nesting season after a burn (MWRL 14(12):2). Production of grass seed is also increased as a result of burning. The mean nest density of one nest per 5.9 acres for burned plots in the second, third, or fourth nest season after burning in March or August was significantly greater ($P < 0.05$) than the density of one nest per 9.3 acres for similar but unburned fields that were in the second nest season, or later, after seeding.

In 1970 and 1971, 17 fields at least 1 acre in size on sanctuaries at Bogota contained more than one nest and had a denisty greater than one nest per 5 acres. Each field represented a small percentage of the total cover searched, but each contained a disproportionately high percentage of the total numbers of nests found on each sanctuary. Twelve of these 17 fields were in the second (9 fields), third (2 fields), or fourth (1 field) nest season after prescribed burning in March or August. These data are significant, because each sanctuary contained 10 to 28 different cover types involving various age-classes, species, burn and nonburn categories, and uses prior to nesting--71 percent of the 17 fields with the high densities were burn types.

Because of the high densities of nests and the high levels of nest success in plots 2 to 4 years after burning, the conclusion can be drawn that prescribed burning has played a significant role in the dramatic population increase that this endangered species has shown in the past 4 years at Bogota.

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Mrs Dodd's Library

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | August, 1972 | Vol. 15, No. 8

Manipulation of Pheasant Habitat

G. B. Joselyn

The investigation of the feasibility of manipulating roadside cover for nesting pheasants has included the annual search of 42 unmanaged control roadside plots. These plots, selected at random from throughout the study area, exist in their usual vegetative state (unseeded), and no attempts are made to control or influence farmer management of these roadsides (mowing and weed spraying). Therefore, such roadsides are considered typical unseeded roadsides on the study area.

Over the 9 years, 1963-71, an average of 28 percent of the acreage making up these roadsides was unmowed on August 1. There was, however, considerable year-to-year variation in the proportion of the total acreage of these roadsides that was unmowed. In 1963, 9.4 of 17.7 acres (53 percent) were unmowed on August 1, but the proportion unmowed decreased each year thereafter until, in 1969, only 17 percent of the acreage (5.4 of 32.0 acres) was not mowed; in 1970 and 1971, about 25 percent of the acreage was unmowed (8 of 32 acres). The extent to which mowing phenology on the study area is typical of that in central Illinois in unknown. However, on the study area, at least, about three-quarters of the randomly selected roadside plots are usually mowed one or more times prior to August 1, thus greatly limiting their potential for producing successful pheasant nests.

Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

The squirrel harvest in 1970, estimated at 2.3 million, was the lowest reported since 1956, according to data from hunter-kill reports. The previous low occurred in 1965, when the harvest was estimated at 2.4 million squirrels. During the 14-year period of 1956-69, the harvest averaged 2.8 million squirrels per year. The squirrel harvest in 1970 was 18 percent less than this long-term mean.

The reasons for this decline in the squirrel harvest in 1970 are not fully known, but one contributing factor was that fewer hunters than usual chose to hunt squirrels that year. During the base period of 1956-69, the proportion of resident hunters who hunted squirrels ranged from 45 to 52 percent, an average of 225 thousand squirrel hunters each year. In 1970, only 193 thousand hunted squirrels, a drop of 14.2 percent from the long-term average.

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Hunter success, in terms of the average number of squirrels bagged per trip, was also well below the average for 1956-69, particularly for the Northern Zone (MWRL 15(7):2). Statewide, the average kill per trip in 1970 was only 1.8 squirrels, compared with the mean of 2.0 squirrels for 1956-69, a decline of 10 percent. In the Southern Zone, hunters averaged 2.0 squirrels per trip in 1970, compared with 2.2 squirrels during 1956-69, a decline of 9 percent. In the Northern Zone, hunters averaged only 1.5 squirrels per trip, compared with 1.8 squirrels during 1956-69, a decline of 17 percent.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

Censuses of quail were made on the Forbes and Dale areas in early March to obtain estimates of the prebreeding population densities. Thirteen coveys, 117 quail (4.8 quail per 100 acres) were observed on Forbes. The prebreeding estimate for Forbes in 1972 was 54 percent greater than was recorded in 1971 and was identical to the long-term mean for the prebreeding estimates. The prebreeding estimate for 1972 represented a decline of 71 percent from the estimated prehunt population in 1971.

Eight coveys containing 85 quail (7.7 quail per 100 acres) were observed on Dale during the prebreeding census in 1972. The prebreeding estimate in 1972 was 27 percent lower than that of 1971 but was 10 percent greater than the long-term mean for the prebreeding estimates. The quail population on Dale declined 72 percent from early November 1971 to early March 1972. Winter losses similar in magnitude to those from November 1971 to early March 1972 have been characteristic of the populations on the two areas.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

There are advantages and disadvantages to prescribed burning in either March or August on prairie chicken sanctuaries in Illinois. Some burning in March is desirable because burning in March appears better for encouraging the development of native prairie vegetation and stimulating legumes. Burning in August appears better for such domestic grasses as redtop and timothy, which have matured and are essentially dormant in August. The rule of thumb here seems to be to burn the cool season introduced grasses in late summer (warm season) and to burn the warm season native grasses in late winter (cool season). Although our data (MWRL 14(12):2) revealed higher densities of nests for August burns than for March burns that were in the second, third, and fourth nest seasons after burning, the above reasons seem to justify the continuation of burning in both seasons.

A desirable feature of burning in August in southern Illinois is that nearly 2 months of growing season are still left, during which a sod can green up before frost. This new leafy material and the mosaic of unburned

patches so characteristic of an August burn may account for the limited nesting recorded in the spring after an August burn. March burns often result in more complete removal of vegetative debris, and there is little time for vegetative growth and duff accumulation prior to the initiation of the earliest (early April) prairie chicken nests in southern Illinois.

August of 1970 and 1971 were both considered too dry to conduct prescribed burning of the proper intensity. Thus, only a limited amount of burning was applied during August of these years. By contrast, over 5 inches of rain was recorded on the Bogota Study Area during the first 2 weeks of August 1972. The high level of soil moisture now provides a prime opportunity for prescribed burning on the prairie chicken sanctuaries.

Ahreat, ...

Mrs. Dodds

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois September, 1972 Vol. 15, No. 9

Manipulation of Pheasant Habitat

G. B. Joselyn

Efforts by the Department of Conservation to seed graded roadsides throughout Ford County were described in an earlier report (MWRL 15(5):1-2). The roadsides graded in 1970, 1971, and 1972 were seeded on 7 days (70 hours) during the period September 6-20, 1972. Brome and alfalfa were seeded along 67 miles of roadside (one side) comprising 134.2 acres in 7 of the 12 townships in the county.

Newly seeded roadsides will be fertilized with 0-46-0 at a rate of approximately 90 lbs per acre either this fall or early next spring. Signs will be placed at the end of each seeded roadside next spring to inform the public why the roadsides remain unmowed.

Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

The squirrel harvest in 1971, estimated at 1.8 million, was the lowest reported since 1956, according to hunter-kill reports. The previous low occurred in 1970, when the harvest was estimated at 2.3 million squirrels. During the base period of 1956-69, the harvest averaged 2.8 million squirrels per year. The squirrel harvest in 1971 was 22 percent less than the harvest in 1970, and 36 percent less than the average for 1956-69.

All of the reasons for this sharp and sudden decline in the squirrel harvest in 1970-71 are not determined. During the period 1956-69, squirrels were the most stable of our major upland game species.

However, one of the reasons for the decline in the squirrel harvest may be simply that fewer hunters than usual were interested in squirrels. During the base period of 1956-69, the number of squirrel hunters ranged from 184,000 to 262,000 (45 to 52 percent of the resident hunters) and averaged 225,000 (48 percent). In 1971, there were only 181,000 (39 percent) squirrel hunters, the lowest number (and proportion) recorded since 1956.

Hunter success, in terms of the average number of squirrels bagged per hunter trip, was also down in 1971, compared with previous years. Illinois squirrel hunters reported an average bag of only 1.7 squirrels per trip, compared with 1.8 squirrels in 1970 and 2.0 squirrels during the period 1956-69.

A widespread failure of the hickory nut crop in 1971 was reported to us by cooperating avid squirrel hunters. This failure resulted in poor hunting during August and September, when squirrels are usually cutting hickory nuts and are therefore easily located by squirrel hunters.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

The Stoddard cock-hen trap, with game-farm hens as decoys, has been used to capture quail on the Forbes and Dale areas since 1964. In 1972, the trapping period extended from mid-May until mid-June. The areas were trapped weekly, and, in addition, were alternately trapped twice a week during June. The traps were in operation from 5 AM to 10 AM, CST.

Mean rates of capture (including recaptures), expressed as quail per trap-day, were greater on the Dale Area than on the Forbes Area, 1.1 and 0.8 quail per trap-day, respectively. The mean rates of capture have varied on Dale from 0.9 quail per trap-day in 1966 to 1.3 quail per trap-day in 1965. On Forbes the mean rates of capture have varied from 0.7 quail per trap-day in 1972 to 1.1 quail per trap-day in 1969.

For the Forbes Area, a significant correlation ($\underline{P}<0.05$) existed between the mean rates of capture and the prebreeding density as determined by censuses with dogs in early March. This correlation did not exist for the Dale Area. Surprisingly, there was no statistical correlation between the mean numbers of calls per stop recorded during audio censuses and the mean rates of capture for either area. The audio censuses and summer trapping were concomitant. These data suggest that the quail response to the cock-hen traps was a function of individual behavior rather than a population phenomenon.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

A total of 85 prairie chicken nests were found in 375 acres of nesting cover on the sanctuaries at Bogota in the summer of 1972. This density of one nest per 4.4 acres searched is the highest ever recorded for the sanctuary system. The previous high was one nest per 5.7 acres searched in 1964 in only 97 acres. Due to manpower shortages this year, we were unable to search 143 additional acres of potential nesting cover.

Of the 85 nests, 6 were of unknown fate and 6 were atypical, having only one egg in a scraped-out depression with little or no bowl of grassy duff. Of the remaining 73 nests of known fate, 47 were successful, 23 were destroyed (either before or after abandonment), and 3 were abandoned. The success level of 64.4 percent was slightly lower than the mean of 66.8 percent for the 9-year period of 1963-71.

cat.

Mrs. Dodds Library

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | October, 1972 | Vol. 15, No. 10

Manipulation of Pheasant Habitat

G. B. Joselyn

Densities of pheasant nests in 1972 on seeded roadside plots averaged 2.5 nests per acre, a 29 percent decline in the rate of establishment from 1971 (3.5 nests per acre). Nest densities in 6 of the past 10 years were higher than the density in 1972. High density for the period was 3.8 nests per acre (1964); the low was 1.7 nests per acre (1969).

Nest densities on managed control roadside plots in 1972 averaged 1.3 nests per acre, representing a 46 percent decline from the average of 2.4 nests per acre in 1971. The density in 1972 is identical to that in 1969 and represents the lowest density on these plots in the past 10 years. The highest density recorded on managed control plots was 2.8 nests per acre in 1963.

Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

Among the most important factors in the management of squirrels are the regulations under which they are hunted. The timing of the open season is particularly significant. In Illinois, the squirrel season has traditionally opened on August 1 in the Southern Conservation Zone and on September 1 in the Northern Zone. This year (1972), the season closes November 15 in both zones. How does the season in Illinois compare with squirrel seasons in surrounding states?

In Wisconsin, the season opens on September 30 and closes January 31. In Indiana, the season opens on August 15 and closes October 13. In Kentucky, the season opens on August 19 and closes October 31, then reopens on November 16 and closes December 31. In Missouri, the season opens on May 30 and closes December 31. The opening date of the season in Iowa is September 9 and the closing date has not yet been set.

The differences in squirrel seasons among the states are due largely to tradition. The squirrel season opens concurrently with other upland game seasons in Wisconsin and Iowa. Illinois, Indiana, Kentucky, and Missouri provide a separate season for squirrels before the general upland game seasons open.

The lengths of the Illinois squirrel seasons (106 days in the Southern Zone, 75 days in the Northern Zone) are conservative when compared with the

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squirrel seasons in the surrounding states. Only Indiana has a shorter open season (59 days), and the Missouri season (215 days) is more than twice as long as those in Illinois. Missouri continues to provide good squirrel hunting despite its traditional long open season and early opening date.

<u>Responses of Bobwhites to Habitat Manipulation</u> J. A. Ellis

Since 1966, 140 acres of a 250-acre portion of the Dale Area have been experimentally managed for quail and other game species by prescribed burning. In 1972, however, approximately 26 of the 140 acres were not burned, due to unfavorable weather conditions.

Vegetative aspects of the 26 acres were strikingly different between 1971 and 1972. It was assumed that the differences were related more to the presence or absence of fire than to other environmental factors such as weather.

A more diverse flora resulted from the continuous use of prescribed burning. In 1971, after 6 years of annual burning, 53 plants were identified in the quadrats, compared with 44 species in 1972. Included in the 10 most abundant plants in 1971 were common ragweed (<u>Ambrosia artemisiifolia</u>), Korean and common lespedeza (<u>Lespedeza stipulacea</u> and <u>L. striata</u>), and wild beans (<u>Strophostyles leiosperma</u> and <u>S. helvola</u>)--all are important sources of quail foods. None of these food plants was among the 10 most abundant plants in 1972. Plants that were more abundant in 1972 than in 1971 were panic grass (<u>Panicum huachucae</u>), lance-leaf ragweed (<u>Ambrosia bidentata</u>), blackberry and dewberry (<u>Rubus allegheniensis</u> and <u>R. flagellaris</u>), foxtail (<u>Setaria viridis</u>), and rough buttonweed (<u>Diodia teres</u>). In addition, the amount of bare ground in 1972 was reduced to half of that in 1971. Thus, prescribed burning must be conducted annually to insure the continuation of high-quality habitat for quail.

<u>Responses of Prairie Chickens to Habitat Manipulation</u> R. L. Westemeier, D. R. Vance

The abundance and distribution of prairie chickens in Illinois is clearly limited by the availability of suitable grassy vegetation for nesting. Thus, providing attractive, safe nest cover is the primary problem in perpetuating remnant flocks of prairie chickens in Illinois. However, such crops as corn, soybeans, wheat, and oats, which have resulted in the elimination of prairie chickens from most of their native Illinois range, have a definite role in the management of nesting sanctuaries.

Old sods that have become heavily invaded with undesirable weeds and woody plants should be fall-plowed, fertilized, and seeded to soybeans for 1 or 2 years--using a herbicide if necessary--and then reseeded to a redtop-timothy-legume mixture, with a small grain, preferably oats, as a nurse crop. This essential renovation is accomplished by sharecropping agreements with local farmers. Soybean stubble provides an ideal site for booming grounds. New seedings of a mixture of small grains, grass, and legumes also provide suitable sites for booming and excellent brood cover. For these reasons, about 20

percent of each sanctuary is scheduled for row crops and small grains annually.

It is neither feasible nor necessary to leave the sanctuary landowner's share of crops in the field for winter food as is the common practice on other state wildlife areas. The availability of winter food has not presented a problem to prairie chickens in Illinois. It is desirable that the landowner's share of crops be harvested and that these monies be used to cover the cost of taxes and the necessary management of sanctuary land. Long-term treatments of limestone and rock phosphate are costly, but essential in the development of quality nest cover for prairie chickens. Fence building, selective basal spraying, mowing for weed and brush control, restoration of native prairie, maintenance of firelanes, and prescribed burning are other management activities that involve some expense but must be accomplished on an annual basis. Revenues from grass and legume seed, grazing, and haying (crops in which a permittee has no investment) also help to minimize the cost of annual management on prairie chicken sanctuaries.

mont,

Mrs. Dodds

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | November 1972 | Vol. 15, No. 11

Pheasant Populations and Land Use

G. B. Joselyn

Hunting pressure on the Sibley Study Area during the opening weekend of the hunting season in 1972 was relatively light but, considering the stage of the soybean and corn harvest, was heavier than anticipated. It is believed that the study area had more standing crops on opening day this year than in any of the previous 10 years. The year 1967 is a close second, but during that year the soybean harvest was completed and the corn harvest was under way before wet weather set in. This year, neither the bean harvest nor the corn harvest was completed on opening day; it was estimated that 80 percent of the soybean crop and 40 percent of the corn crop had been harvested. Very little fall plowing has been completed.

This year, 123 hunters were interviewed on the study area on the opening weekend. They hunted 397 man-hours and killed 55 pheasants (7.2 hours per bird). In 1971, when the harvest was virtually complete and fall plowing well under way, bagging a pheasant took only 1.4 hours. In only 2 years since 1962 has bagging a pheasant during the opening weekend taken longer than 7 hours (8.0 hours in 1965, 8.1 hours in 1967). The numbers of hours in the field to kill a pheasant, 1962 through 1970, were, respectively, 2.2, 2.7, 2.1, 8.0, 6.9, 8.1, 5.0, 4.3 and 4.7 hours.

The lengthy time required to bag a pheasant this year is a direct result of the standing crops and the lack of fall plowing on the study area. Most pheasants were taken out of standing corn, where hunters reported that the birds were plentiful.

Manipulation of Pheasant Habitat

G. B. Joselyn

In the last Monthly Wildlife Research Letter (15(10):1), it was reported that densities of pheasant nests this year (1972) on seeded roadside plots (2.5 nests per acre) represented a 29 percent decline in the rate of establishment from 1971 (3.5 nests per acre). The highest nest density reported over the past 10 years on seeded plots was 3.8 nests per acre in 1964; the low was 1.7 nests per acre in 1969. Nest densities on managed control plots in 1972 averaged 1.3 nests per acre, 46 percent less than the average of 2.4 nests per acre in 1971.

Successful nest production (1.1 nests per acre) on seeded plots in 1972 represented a substantial increase (57 percent) over 1971 (0.7 nest per acre) and only the second time since 1963 that unit area production on seeded plots has exceeded one hatched nest per acre (there were 1.1 successful nests per

acre in 1963 also). Over the past 10 years, production on seeded plots has ranged from 0.5 nest per acre in 1967 to the 1.1 nests per acre in 1963 and 1972. Average for the 10 years is 0.8 nest per acre.

Production on managed control plots in 1972 was 0.5 nest per acre, compared with 0.7 nest per acre in 1971. Since 1963, successful nest production on managed control plots has varied from 0.3 nest per acre in 1964 to the 0.7 nest per acre in 1971.

Since 1963, 142 nests have hatched on seeded plots, compared with 89 nests on managed control plots.

Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

One aspect of the squirrel project deals with a survey of the distribution and abundance of gray squirrels over the state. As part of this job, we conducted a post card survey of 108 community parks throughout Illinois, asking whether gray, fox, or both species of squirrels were present in these parks. Usable returns have been received from 66 parks (61.1 percent), most of them in the Northern Conservation Zone.

Statewide, both gray and fox squirrels were reported from 38 communities. Nine communities (8 from the Chicago area) reported gray squirrels only, and 17 communities reported fox squirrels only. Two communities, both in Cook County, reported no squirrels in their parks.

The Northern Conservation Zone was heavily represented with 60 of the 66 returns. Both gray and fox squirrels were reported from 36 communities in this zone. Only gray squirrels were reported by 8 communities, and 14 towns reported only fox squirrels.

Six returns were received from the Southern Conservation Zone, indicating two towns with both species, one with only gray squirrels, and three with only fox squirrels.

Black squirrels, a melanistic color phase of the common gray squirrel, were reported by 10 communities, mostly along the shoreline of Lake Michigan north of Chicago. Black squirrels were also reported from Rock Island and Quincy on the Mississippi. Normal gray squirrels were reported by all 10 of these communities, and 7 of the 10 communities also reported fox squirrels.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

Censuses of quail were made on the Dale and Forbes areas in late October and early November to obtain estimates of the prehunt densities. Thirty-five coveys, 555 quail (22.8 quail per 100 acres) were observed on Forbes. The prehunt estimate for Forbes in 1972 was 40 percent greater than was recorded in 1971, was 14 percent greater than the long-term mean for prehunt estimates, and represented an increase of 268 percent from the estimated prebreeding population in 1972.

Twenty-five coveys containing 426 quail (38.7 quail per 100 acres) were observed on the Dale Area during the prehunt census in 1972. The prehunt estimate in 1972 was 41 percent greater than that of 1971, was 33 percent greater than the long-term mean for the prehunt estimates, and represented an increase of 255 percent from the prebreeding estimate. The prehunt estimate in 1972 for Dale was exceeded only by the prehunt estimate in 1968 (44.1 quail per 100 acres).

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Statistics on mean clutch size, the mean number of fertile eggs per clutch, and the mean number of hatched eggs per clutch for prairie chickens in 1972 were significantly higher ($\underline{P} < 0.05$) than the means for 1971. In 1971, the means for clutch size and hatched eggs per clutch were the lowest of the annual means for the 10-year period of 1963-72 on the Bogota Study Area.

In 1972, the means were 12.5 for clutch size (31 clutches), 11.8 fertile eggs per clutch (28 clutches), and 11.4 hatched eggs per clutch (30 clutches). Until 1972, the largest clutch of prairie chicken eggs in a sample of 118 clutches of known size was 17 eggs. In 1972, however, a clutch of 25 eggs, a clutch of 19 eggs, and another clutch of 17 eggs were found at Bogota. The shells of the eggs in the phenomenal clutch of 25 eggs were in excellent condition when found (on June 29) and all 25 eggs had hatched. A clutch this large may represent the efforts of more than one hen, but this possibility cannot be discounted for any clutch of two or more eggs. Even if we exclude the clutch of 25 eggs from the data for 1972, the means for clutch size and for fertile and hatched eggs per clutch were slightly higher than the means for the preceding 9-year period.

Previously [MWRL 12(1):2 and 12(2):3], a tolerance limit in spacing of nests was suggested on the basis of nest success and clutch size in relation to nearest-neighbor spacing of nests. Nest success and clutch size decreased with nearest-neighbor spacing of less than 120 yards. It is of interest that the large clutches found in 1972 and one of the highest rates of nest success (72.1 percent) occurred on the adjoining Yeatter, Field, and McGraw sanctuaries. This half-section area contained the highest known density of pinnated grouse in North America in 1972. These data must be subjected to a more comprehensive analysis to learn whether our previous hypotheses on spacing of nests are still valid.

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | December, 1972 | Vol. 15, No. 12

Pheasant Populations and Land Use

G. B. Joselyn

In 1972, pheasant hunting began at sunrise on opening day instead of at noon, as had been the practice in past years. One reason for changing to a sunrise opening was to provide additional hunting time on opening day.

Since the sunrise opening constituted a significant change from past policy, hunters on the Sibley study area were interviewed during the opening weekend to determine their attitude toward the lengthened hunter-day. During the 2 days, 123 hunters were interviewed. Fifty-four, selected at random, were asked their opinion of the sunrise opening. The rather interesting results of the random sampling are shown below. No hunters volunteered any comments on the early opening time.

	Number of Hunters	Percent
Did not like change		
Had to get up too early in order to arrive at hunting spot by dawn	10	19
Got too tired by noon	5	9
Subtotal	15	28
Neutral on change	4	7
Liked change		
No reason given	7	13
Can hunt longer on opening day	28	52
Subtotal	35	65
Total	54	100

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Manipulation of Pheasant Habitat

G. B. Joselyn

Because unmanaged control plots represent "typical" roadsides on the study area (in that mowing is not controlled), differences in pheasant nest densities between this type of roadside and seeded plots are considered the best indicators of the response by pheasants to the seeding of roadsides.

For the 10 years, 1963-72, pheasant nest density on seeded plots (2.7 nests per acre) was 2.4 times that on all (mowed and unmowed) unmanaged control plots (1.1 nests per acre). Nest density on seeded plots was 3.4 times that on mowed, unmanaged control plots (0.8 nest per acre) but only about 1.4 times greater than the density on unmanaged control roadsides that were unmowed (1.9 nests per acre), thus indicating that merely leaving roadsides unmowed could result in meaningful benefits to nesting pheasants.

Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

Hickory seed has long been recognized as a staple food of gray and fox squirrels throughout their range in eastern North America. Hickory seed is usually cached or eaten by squirrels before extensive feeding on acorns begins, and squirrel hunters usually concentrate their hunting efforts in or around hickory groves in early fall.

The size of the hickory seed crop may be very important to the maintenance of gray squirrel populations. During a 10-year study to determine the effects of oak and hickory seed crops on a gray squirrel population, the fall-to-fall survival rate of adult gray squirrels was significantly correlated ($r = +0.89$, $P < 0.05$) with the size of the hickory seed crop.

Hickory seed kernels are higher in fat content and in calories per gram of dry weight than are acorns. Squirrels feeding on a bumper crop of hickory seed gain weight rapidly during the fall months and enter the winter months in prime condition. Winter survival of all age-classes for both species of squirrels probably depends on their physical condition when winter begins, particularly in northern Illinois, and access to plentiful supplies of hickory seed materially improves the condition of squirrels and thus their chances of winter survival.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

For the years 1964-70, hunting has removed 32 to 74 percent ($\bar{X} = 59$) of the fall populations of quail on Forbes and 54 to 81 percent ($\bar{X} = 68$) on Dale. The quail populations on these areas have remained markedly unaffected by this degree of utilization. No relationship existed between proportionate harvest levels and subsequent fall populations.

Furthermore, significant negative correlations ($P < 0.01$) were found between

harvest levels and additional winter losses for both Forbes ($\underline{r}$ = -0.967) and Dale ($\underline{r}$ = -0.871). Total winter mortality among the quail populations, from the prehunt estimates to the prebreeding estimates, averaged 80 percent of the fall populations on Forbes and 77 percent on Dale. The negative correlations indicated that low winter losses offset high harvests and, conversely, that high winter losses occurred after low harvests. Bobwhite populations declined to 15 to 30 percent of prehunt densities by the subsequent spring, regardless of the size of the harvest.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

The original 16-square-mile (10,240 acres) Bogota Study Area was established in 1962 and in the summer of 1963 was thoroughly cover-mapped. We completed another mapping of the area in 1972 in order to document land-use changes on private land over the 10-year period. The dominant crop, soybeans, totaled about 4,200 acres or 41 percent of the study area in both years. Two major changes in land use occurred during this period--(1) corn acreage increased from 1,900 acres to 2,670 acres (18.5 to 26.2 percent of the total area) with a corresponding reduction in the acreages of small grains (primarily wheat), pasture, legume hay, undisturbed legumes, and grass hay; (2) prairie chicken sanctuaries increased from 77 acres to 635 acres. (The remaining 325 acres of sanctuaries at Bogota are outside the original study boundaries or have been acquired since the cover-mapping in 1972.) The total acreage of undisturbed grass increased slightly from 505 acres to 619 acres. However, undisturbed grass on private land decreased from 428 acres in 1963 to 188 acres in 1972. Undisturbed grass on prairie chicken sanctuaries increased from 77 acres to 431 acres during the same period. In 1972, only about 78 acres of the 188 acres of undisturbed grassland on private land could be considered good nest cover.

The slight increase in the total quantity of undisturbed grass cannot account for the increase in the prairie chicken flock from about 156 birds in the spring of 1963 to about 400 birds in the spring of 1972. Through the acquisition and management of sanctuaries, the 428 acres of poor-quality and hazardous nest cover available on private land in 1963 was replaced with 431 acres of safe high-quality nest cover on sanctuaries by 1972. In short, an acre of grass on sanctuary land will support two to three times (or more) prairie chickens than an acre of grass on private land.

ncat.

Lois Dodd

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | January, 1973 | Vol. 16, No. 1

Manipulation of Pheasant Habitat

G. B. Joselyn

It was pointed out in the previous report (MWRL 15(12):2) that differences in pheasant nest densities between seeded and unmanaged (mowing not controlled) roadsides on the study area are considered the best indicators of the response by pheasants to the seeding of roadsides. For the 10 years, 1963-72, pheasant nest density on seeded plots (2.7 nests per acre) was 2.4 times that on all (mowed and unmowed) unmanaged control plots (1.1 nests per acre).

Density of successful (hatched) nests on seeded plots for the 10 years (0.8 successful nest per acre) was 2.7 times the density of successful nests on all unmanaged control plots (0.3 successful nest per acre). On mowed, unmanaged control plots, density of successful nests was 0.2 per acre for the 10 years; on unmowed, unmanaged control plots, the success rate was 0.6 nest per acre. The density of successful nests on seeded plots ranged from 0.5 to 1.1 during the 10 years. On mowed, unmanaged control plots, the range was 0.0 to 0.4 successful nest per acre during those years, and unmowed, unmanaged control plots had from 0.4 to 1.1 successful nests per acre.

Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

A total of 59 squirrel-hunter cooperators in the Northern Conservation Zone returned usable hunting-report booklets for the hunting season of 1972. This total represents a 42.1 percent return after one follow-up reminder to return the booklet.

Cooperators were asked to report the date, length, and success of each squirrel hunt and the reproductive status (pregnant or nursing) of female squirrels that were bagged.

One of the most important aspects of squirrel management is the timing of the hunting season in relation to the summer breeding cycle. Squirrel hunting in northern Illinois traditionally opens on September 1, when many adult females are nursing young. These females in the hunter's bag represent the loss of baby squirrels that die of starvation.

Data derived from 1,233 squirrels (77.1 percent fox squirrels, 22.9 percent gray squirrels) bagged in the Northern Zone during the hunting season of 1972 indicate that only 16 of 270 (5.9 percent) of the adult females in the bag were nursing and none were pregnant. The proportion of adult females that were

nursing during the 4 weeks of September ranged from 8.1 to 12.0 percent each week.

The incidence of nursing females in the hunter's bag declined to near zero after September 28. Among 82 adult female fox squirrels reported bagged after September 28, only one was lactating and one was pregnant (one embryo). There were no pregnant or lactating females in the sample of 28 adult female gray squirrels bagged after September 28.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

Quadrat samples of vegetation were made in five different cover types on the experimental management zone on Forbes in 1971 and 1972. These cover types in 1971 were 1- and 2-year-old unharvested corn and 1-year-old oat stubble. In 1972 these cover types included 1- and 2-year-old oat stubble. Importance values were calculated for plant species found in the quadrats. The importance values represented the average of total vegetation for a given species times its frequency of occurrence (as a decimal) over all quadrats for a given cover type. To compare the species composition of plants among various cover types, indices of similarity were calculated for the 10 most important plants of each cover type.

The 1-year-old oat stubble in 1972 contained the most diverse flora, 46 species, and the least amount of bare ground, 14 percent. In 1971, the 2-year-old unharvested corn contained the fewest plants, 35, and the 1-year-old unharvested corn contained the most bare ground, 34 percent.

The most similar cover types were 1- and 2-year-old oat stubble sampled in 1972, 82 percent. The least similar cover types were the 1- and 2-year-old unharvested corn sampled in 1971, 18 percent. The latter represented the influence of edaphic and climatic conditions rather than general cover type.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

A recent development planned for the area immediately west of the Bogota Study Area has the possibility of benefiting prairie chickens or of doing them considerable harm. Central Illinois Public Service Company (CIPS) is now purchasing land for an 8,000-acre, steam-powered generating complex and cooling lake. The Nature Conservancy is directly involved, because CIPS wants to purchase 10 acres off the west end of the Fuson Farm sanctuary. The $140,000,000 plant will initially generate 600,000 kilowatts and burn approximately 2,000,000 tons of coal annually.

This project could conceivably double the present 960 acres available for prairie chicken management in Jasper County. Approximately 1,000 acres of the land acquired is gray prairie farmland that would be suitable for prairie chicken management. At this point, we do not know whether the opportunity for management will be presented.

Among the potential adverse factors associated with this project are (1) people, (2) transmission lines, and (3) air pollution. Many of the 1,000 construction workers will be driving through the sanctuary area daily. Trespassing and poaching on the sanctuary area may increase to significant levels. Also, recreational and real estate developments around the lake could, depending on their nature and location, have detrimental effects on efforts to preserve prairie chickens. Although the high-capacity transmission lines on steel pylons pose no threat to flying chickens as the lines are now proposed, these obstructions would be a real hazard and would add an objectionable unaesthetic character if they were to cross the sanctuary area in the future. Air pollution from burning 2,000,000 tons of high-sulfur Illinois coal annually will probably not be a problem if, as anticipated, strict antipollution measures are taken.

Representatives from CIPS, the Illinois Department of Conservation, and the Illinois Natural History Survey have met and discussed the many ramifications of the Jasper County project. It is entirely feasible that, with cooperation, Illinoians and Illinois prairie chickens could all benefit from this project.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois February, 1973 Vol. 16, No. 2

Manipulation of Pheasant Habitat

G. B. Joselyn

Efforts by the Department of Conservation to seed graded roadsides throughout Ford County during September 1972 were described in an earlier report (MWRL 15(9):1). This project involved the seeding of brome and alfalfa on 67 miles of graded roadsides in the county. Weather conditions during the winter just ending exemplify one problem encountered in obtaining a successful "take" of such seedings.

Above-normal precipitation (mostly rain) during the last 3 months of 1972 drenched ground already saturated from heavy September rains. Insulating snow cover has been virtually absent, and alternating periods of thawing and freezing have been prevalent. These conditions are ideal for causing heaving of roadside soils with attendant damage to brome and alfalfa seedlings. The extent of the damage--possibly extensive--will be unknown until spring.

Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

One of the most important aspects of squirrel management is the timing of the hunting season in relation to the reproductive cycle. The squirrel hunting season in southern Illinois traditionally opens on August 1, when many adult females are pregnant or are nursing young. These females in the hunter's bag represent the loss of unborn young and of baby squirrels that die of starvation.

Data derived from 3,597 squirrels bagged in the Southern Conservation Zone during the squirrel hunting season of 1972 indicate that about 14 percent of the adult females harvested were pregnant or nursing (compared with 17 percent in 1971). The proportion of adult females that were pregnant or nursing was high during August and peaked at approximately 20 percent during August 1-14 (compared with a peak of 27 percent during August 16-31, 1971). Reproductive activity declined sharply after August 28. Less than 14 percent of the adult females shot during August 29-September 11 were pregnant or lactating (compared with 13 percent last year), and the proportion was below 9 percent for the remainder of the hunting season. There were no pregnant or lactating females in our sample of 158 adult females harvested September 26-November 15.

Unfortunately, many hunters are reluctant to admit that they are shooting nursing or pregnant squirrels. Thus, information received from squirrel hunters should be construed as only an index of the numbers of breeding females killed each year.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

The hunting season for quail was extended 31 days during 1972, an increase of 67 percent compared with the season of 1971. Harvest data collected on the Forbes and Dale areas revealed higher kills on both areas in 1972 than in 1971. On Forbes, 13 quail per 100 acres were harvested during the 1972-73 season, an increase of 38 percent over the harvest of 1971 and 4 percent greater than the long-term mean harvest for the area. Hunting effort (gun-hours) on Forbes during the 1972-73 season was 58 percent greater than the long-term mean for the area.

On Dale, 23.3 quail per 100 acres were harvested in the 1972-73 season, an increase of 41 percent over the harvest of 1971 and 4 percent greater than the long-term mean harvest for the area. The hunting effort on Dale in 1972-73 was 30 percent greater than the long-term mean for the area.

The 31 days added to the hunting season of 1972-73 represented 40 percent of the total hunting opportunity. During this period, 17 percent of the hunting effort was expended and 10 percent of the harvest was recorded for the Forbes Area. At Dale, 8 percent of the hunting effort and 9 percent of the kill occurred during the extended portion of the season.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Over the past 10 years (1963-72), intensive nest-searching on foot on sanctuary grasslands has been our primary means of gaining an understanding of the nesting ecology of prairie chickens. We now have detailed information on 312 prairie chicken nests found in the 4,117 acres searched. Twenty-six additional prairie chicken nests were found, mostly by cooperating local farmers, and were examined by project personnel. Also, by including reliable reports of nests, most of which were destroyed by plowing, data have been accumulated on more than 400 prairie chicken nests. To our knowledge, no other state in the range of the greater prairie chicken has a body of information of this magnitude.

As a by-product of the nest study on prairie chickens, we have also located and recorded detailed information on 3,844 nests of other birds, including: 227, bobwhite quail (Colinus virginianus); 21, ring-necked pheasant (Phasianus colchicus); 174, mourning dove (Zenaidura macroura); 28, upland plover (Bartramia longicauda); 14, short-billed marsh wren (Cistothorus platensis); 2,134, red-winged blackbird (Agelaius phoeniceus); 658, eastern meadowlark (Sturnella magna); 399, dickcissel (Spiza americana); 112, field sparrow (Spizella pusilla); 47, grasshopper sparrow (Ammodramus savannarum); 2, Henslow's sparrow (Passerherbulus henslowii); 3, song sparrow (Melospiza melodia); 16, goldfinch (Spinus tristis); 1, mockingbird (Mimus polyglottos); 2, catbird (Dumetella carolinensis); 1, brown thrasher (Toxostoma rufum); 3, cardinal (Richmondena cardinalis); 2, indigo bunting (Passerina cyanea); and 2 instances of nest parasitism by brown-headed cowbirds (Molothrus ater). We have also recorded 175 rabbit (Sylvilagus floridanus) nests. Further evaluation of these data may provide valuable insight into the nesting habits of several grassland and game species and demonstrate the value of carefully husbanded grassland habitat now uncommon in Illinois.

neat.

Doris Dodds

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | March, 1973 | Vol. 16, No. 3

Manipulation of Pheasant Habitat

G. B. Joselyn

For large-scale programs of roadside seeding to be successful, cooperating farm operators must refrain from mowing their roadsides until about July 31. Widespread mowing much before this date would greatly diminish the value of seeded roadsides as nest cover for pheasants and other birds. Whether most farm operators on the FCMU would delay the mowing of their roadsides (as agreed) until the date specified was a primary aspect of the program on that area. Frequent mowing of roadsides by farmers, beginning in June, is typical practice throughout much of central Illinois--it is uncommon to find a roadside that is unmowed on July 31. Thus, for farmers on the FCMU to refrain from mowing until the date requested by Department biologists constitutes a departure from past practice.

During the summer of 1967, before the farmers on the FCMU had been contacted regarding the seeding of roadsides, checks were made on the progress of mowing on the study area. Nearly 60 percent of the roadsides had been mowed by June 15 and nearly 90 percent by July 15.

Last summer (1972), as in 1970 and 1971, cooperating farmers on the FCMU generally adhered to the delayed-mowing agreement, although there was a slight increase in the percentage of roadsides mowed. In 1970, about 10 percent of the roadsides of cooperating farmers had been mowed by July 31; about 14 percent were mowed by that date in 1971 and 18 percent in 1972. These percentages contrast with 97 percent of the roadsides mowed by this date in 1967.

Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

In 1972, a sample of 93 cooperating squirrel hunters in the Southern Conservation Zone averaged 2.88 squirrels killed per hunter trip, compared with 2.93 squirrels killed per trip during 1971. Hunting success was low during the opening 2 weeks of the season (2.42 squirrels killed per trip in 1972 compared with 2.49 in 1971) despite heavy hunting pressure, probably because squirrels are difficult to locate in heavy summer foliage until mid-August, when they begin actively "cutting" seed crops. Hunter success increased sharply during the last half of August (3.18 squirrels killed per hunter trip in 1972, 3.00 in 1971) and maintained a high level (2.86 or more) until the last week of the season, when success dropped to 2.26 squirrels killed per hunter trip. The highest success

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rate (3.18 squirrels harvested per hunter trip) was attained during the August 15-September 11 period. The highest rate of success in 1971 (3.43 squirrels per trip) occurred during October 16-31, when seed crops had fallen from the trees and squirrels were foraging on the ground.

Our sample of 93 cooperating avid squirrel hunters in the Southern Conservation Zone went squirrel hunting a total of 1,247 times--representing approximately 3,296.5 man-hours of recreation--during the hunting season of 1972. Hunting pressure was highest during the first 2 weeks of the season (August 1-14), when our cooperators spent 908.75 man-hours in the field--representing 27.6 percent of their total hours afield for the entire 14-week season, about the same proportion as in 1971. In 1972, hunting pressure remained high during the last 2 weeks of August, in contrast to 1971, when hunting pressure declined sharply during that period. During the period August 29-September 11, hunting pressure declined to 17.4 percent of total hours afield and continued its slow decline throughout the remainder of the season. There was no increase in hunting pressure during October 1972, as there had been in 1971. Hunting pressure was low, less than 10 percent of total hours afield, after September 11.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

To determine the effects of the extended quail hunting season in 1972-73, the harvest data were separated into a November-December segment and a January segment. On Forbes, an average of 3.2 gun-hours were spent to locate a covey in November-December, compared with an average of 7.4 gun-hours in January. An average of 4.5 gun-hours were required for each kill in the November-December segment, compared with an average of 7.8 gun-hours per kill in January. The kill per hunter trip averaged 0.8 quail during November-December and 0.5 quail in January.

On the Dale Area, the average number of gun-hours required to locate a covey was 2.7 in November-December and 2.1 in January. To record a kill, the average number of gun-hours required was 3.6 during November-December and 3.0 in January. The kill per hunter trip averaged 1.0 quail in November-December and 0.6 quail in January.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

During the period 1963-72 at Bogota, the distances from 319 prairie chicken nests to the estimated centers of the nearest booming grounds have ranged from 72 yards to 1,700 yards, with respective mean, mode, and median distances of 327 $\pm$ 10 (SE) yards, about 235 yards, and about 285 yards. Only 3 nests (0.9 percent) were less than 100 yards from a booming ground and only 45 nests (14.1 percent) were more than 449 yards from a booming ground. Thus, 85.9 percent of the nests found at Bogota have been within about 0.25 mile from the center of the nearest booming ground. For six nests found farther than 0.5 mile from a booming ground, it is possible that one or two undetected cocks boomed in the vicinity of the

nest site and possibly mated with the hens responsible for these nests. Such small booming grounds occasionally occur and they are difficult to locate during booming ground surveys.

The mean distance of 122 nests from the estimated centers of 10 booming grounds completely surrounded by nest cover was 275 yards. These nests tended to encircle the booming grounds in radial patterns.

These data indicate that a 0.25-mile radius from a booming ground encompasses a vitally important segment of the reproductive habitat for the birds using a particular booming ground. Such zones surrounding display grounds are presumably not inviolate--exchanges of hens (and cocks) probably occur commonly between grounds. However, it is reasonable to assume that most cocks and hens are anchored to certain booming grounds and that the hens mated on a particular ground will nest closer to that ground than to a neighboring ground. Exchanges of prairie chickens between booming grounds must be in the minority and management must focus on the behavior of the majority.

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Doris Dodds

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | April, 1973 | Vol. 16, No. 4

Manipulation of Pheasant Habitat

G. B. Joselyn

Data collected from the Sibley Study Area, 1963-72, show that on a per-acre basis, managed seeded roadsides produced about three times the number of successful pheasant nests as unmanaged roadsides. It is therefore reasonable to infer that seedings over a large area could nearly triple pheasant production on roadsides. However, the question of whether seedings over a sizable area would have sufficient impact on the pheasant population to justify the cost of the seedings remains unanswered. In evaluating the potential of managed seeded roadsides as a management tool, the question is to what extent they could be expected to supplement other production--not whether they could by themselves produce enough birds to insure a huntable population in a given area.

At the beginning of this research project in 1962, 9.4 percent of the land on the Sibley Study Area was in hay; by 1972 this percentage had dwindled to 2.6 percent, with indications of further decreases in the future. Thus, it is possible that roadsides, only 1.3 percent of the study area, will constitute the largest segment of potential nesting cover for pheasants within a few years.

In 1970, the 149.2 acres of managed seeded roadsides increased the hay acreage on the Ford County Management Unit (FCMU) from 402 to 551 acres (37 percent). At the same time, however, the acreage of unseeded roadside cover on the area was reduced by over 90 percent. In 1971, seeded roadsides increased the total hay acreage on the area from 310 to 459 acres (48 percent), but in 1972, more hay was present on the area than in recent years (468 acres), and the increase from the seeded roadsides was only 32 percent (to 618 acres).

Changes in the Federal Feed Grain Program for 1973 portend a decline in hay acreage on the area this coming summer. Thus, this year the contribution of the seeded roadsides to total hay acreage on the area may exceed the 48 percent increase that occurred in 1971.

Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

The squirrel hunting season in northern Illinois traditionally opens on September 1, a month later than in southern Illinois. Our sample of 59 avid squirrel hunters in the Northern Conservation Zone averaged 2.63 squirrels killed per hunter trip during the hunting season of 1972, compared with 2.88 squirrels per trip in the Southern Conservation Zone. Hunting success was slightly above average from September 1 to October 12 (2.67-2.74 squirrels per trip for each 2-week period) and somewhat below the season average from October 13 to November 15 (2.33-2.34 squirrels per trip for each 2-week period). The highest rate of success

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was attained during September 15-28 (2.74 squirrels harvested per hunter trip), but hunter success was almost as high during the first 2 weeks of the season (2.70 squirrels killed per trip). In contrast, hunter success during the first 2 weeks of the season in the Southern Zone was low (2.42 squirrels killed per trip) but increased sharply during the last half of August, when squirrels begin "cutting" seed crops.

Our sample of 59 cooperating avid squirrel hunters in the Northern Conservation Zone went squirrel hunting a total of 469 times during the hunting season of 1972. This number of hunter trips represents approximately 1,215 man-hours of recreation. Hunting pressure was highest during the first 2 weeks of the open season (September 1-14), when our cooperators made 190 squirrel hunting trips. This total represents 40.5 percent of the total number of hunting trips for the entire 10-week season. In contrast, our cooperators in the Southern Zone made only 27.3 percent of their total number of squirrel hunting trips (for the entire season) during the first 2 weeks (August 1-14) of their 14-week hunting season. During the second 2 weeks of the season, hunting pressure among our cooperators in the Northern Zone dropped by nearly one-half, to 102 squirrel hunting trips (21.7 percent of total trips). Our cooperators in the Southern Zone made nearly as many trips during the second 2 weeks of their season (August 15-28) as they had made during the first 2 weeks. Hunting pressure in the Northern Zone declined slowly after September 28.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

The posthunt census of quail was conducted on the Dale and Forbes areas during early February 1973. Because of the extended quail season in 1972-73, the posthunt census occurred 1 month later than in the previous years. On the Dale Area, 14 coveys containing 127 quail (11.6 quail/100 acres) were recorded during the census in 1973. This posthunt estimate was 6 percent greater than the posthunt estimate obtained in 1972 and was the same as the long-term mean for the posthunt populations on the area. Estimates of the posthunt populations on Dale have ranged from 5.5 quail/100 acres in 1966 to 18.1 quail/100 acres in 1968.

On Forbes, 13 coveys containing 136 birds (5.6 quail/100 acres) were flushed during the posthunt census in 1973. This estimate was 10 percent lower than the posthunt estimate for 1972 and 21 percent lower than the long-term mean for the posthunt populations. Posthunt population estimates on Forbes have ranged from 2.4 to 9.9 quail/100 acres in 1966 and 1969, respectively. On both areas the quail populations sustained the extended hunting season in 1972-73 in satisfactory numbers.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

As in the past 10 springs, booming ground surveys were conducted this spring (1973) on the Bogota Study Area at no less than weekly intervals from mid-March through mid-April. These data were supplemented by observations recorded almost daily by visitors in blinds on several booming grounds. Counts were made during the first 1.5 hours after daybreak, and an effort was made to determine the maximum number of cocks on the area.

The peak count of 203 cocks at Bogota this spring was essentially the same as the peak count of 196 cocks in the spring of 1972. Censusing of booming grounds this spring was generally hampered by high winds, frequent rain or snow, persistent cloudiness or fog, and the abundant cover present on private farmland. Plowing or disking of soybean, corn, or wheat stubble was minimal because of the wet fall of 1972. Because of these unfavorable conditions, the count at Bogota may be somewhat conservative for this spring. A high degree of instability was noted throughout the breeding season from the standpoints of (1) numbers of cocks regularly present on booming grounds and (2) locations of booming grounds.

Except for two minor booming grounds involving two cocks each, all booming was located on or in close proximity to the sanctuaries. The apparent super-saturation of 135 cocks in 1972 on the adjoining Yeatter, Field, and McGraw sanctuaries (232 acres in the traditional central core of the Bogota Area) declined to about 110 cocks this spring. Between the springs of 1972 and 1973, increases were noted on the Donnelley Brothers Sanctuary (+26 percent), Mr. and Mrs. Chauncey McCormick Sanctuary (+100 percent), and the adjoining Stuart H. Otis Sanctuary and Fuson Farm (+56 percent). Two cocks boomed regularly near the 80-acre Jamerson McCormack Sanctuary this spring, compared with one cock in the spring of 1972. The same number of cocks (11) were observed on or in the vicinity of the Cyrus Mark 17- and 40-acre sanctuaries.

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D. Y Dodds

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois May, 1973 Vol. 16, No. 5

Pheasant Populations and Land Use

G. B. Joselyn

During the period 23-30 April 1973 systematic counts of pheasants were conducted along 57 miles of all-weather roads on the Sibley Study Area. Observations were confined to only one side of the road along the 16 miles of these roads that border the study area. As in the past 4 years, the observations were restricted to the first 2 hours after sunrise, which allowed coverage of half the roads each morning. Four counts were obtained for each road.

These counts revealed 44 percent more cocks in 1973 than in 1972, 10 percent fewer than in 1971, and 32 percent more than in 1970. The counts in 1973 recorded 293 cocks (151 per 100 miles), compared with 204 cocks (105 per 100 miles) in 1972, 325 cocks (168 per 100 miles) in 1971, and 222 cocks (114 per 100 miles) in 1970. Accurate data on winter sex ratios were virtually impossible to obtain during the winter of 1972-73 because of a lack of snow cover on the study area. Therefore, sex-ratio data collected by W. L. Preno, Illinois Department of Conservation, for Game Region 4 (36 cocks per 100 hens) were utilized for calculating spring hen density. Sex ratios of 40, 37, and 26 cocks per 100 hens were obtained on the study area in 1970, 1971, and 1972, respectively.

By using these figures, hen indices for 1970 were calculated at 555; for 1971, 878; for 1972, 785; and for 1973, 814. Because data on sex ratios were unobtainable on the study area last winter, the hen index for 1973 probably has a greater degree of inaccuracy than in most years. Over the past 12 years, the spring hen index on the study area has varied from a high of 1,322 in 1963 to a low of 491 in 1967.

Manipulation of Pheasant Habitat

G. B. Joselyn

The seeding of 67 miles of roadside (one side) in 7 of 12 Ford County townships in September 1972 was described in a previous report (MWRL 15(9):1). Most of these roadsides were checked for seeding success on May 17. It was found that many of the roadside seedings appeared to have failed completely or to be in such various and unacceptable developmental stages as to preclude their being left unmowed this coming summer. Consequently, all cooperating farmers will be notified by mail that they are encouraged to mow their roadsides as needed during this coming summer and that reseeding will be undertaken, where necessary, in late summer.

There are several possible reasons or combinations of reasons why most seedings appear to be less than adequate: (1) seeding was done too late (6-20 September), (2) fertilizer was not applied at the time of seeding, (3) heavy

rains in the fall washed seed on foreslope and on backslope areas into ditches, where the seedlings that sprouted drowned in high water, and (4) winter periods of frost and ice unaccompanied by protective snow cover made seedlings highly susceptible to winter kill. It is possible that these seedings, like others that at first seemed to be failures, will recover and do well. Nevertheless, planning is under way to reseed in August should the seedings not recover.

Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

The present distribution and relative abundance of gray squirrels in Illinois were determined by asking conservation officers, farm foresters, park superintendents, biologists of the Illinois Department of Conservation, and University biologists to pinpoint the range of gray squirrels in areas of the state familiar to them. Townships and river drainages were used as the units for delineating range occupied by gray squirrels. For each township, these sources were asked to indicate the relative abundance of gray squirrels as follows:

1. Common: frequently shot or seen

2. Scarce: shot or seen every year, but only in low numbers

3. Rare: shot or seen very infrequently, only every 2 or 3 years

4. Absent

Ten townships were then selected in each of the two Conservation Zones for each category of gray squirrel abundance. Recent aerial photographs or topographic maps of these townships were examined to determine the amount of woodland present in each township. While these data have not yet been analyzed, some interesting relationships are apparent between gray squirrel abundance and the amount of woodland present in each township.

In the Northern Conservation Zone, the 10 townships in which gray squirrels were reported to be common had a mean of 20.3 percent woodland. A similar sample in which gray squirrels were reported to be scarce had a mean of 14.0 percent woodland. Samples in which grays were reportedly rare or absent had means of 4.5 and 4.6 percent woodland, respectively.

In the Southern Conservation Zone, 10 townships in which gray squirrels were reported to be common had a mean of 34.7 percent woodland. A similar sample in which grays were reportedly scarce had a mean of only 12.2 percent woodland. An adequate sample of townships in the Southern Zone where gray squirrels are rare or absent could not be examined because up-to-date maps were unavailable.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

Nightlighting was used on the Forbes Area in 1971 and 1972 to evaluate habitat use of small-grain stubble fields of various ages by bobwhites and cottontails. During these 2 years, 137 acres of first-year, 60 acres of second-year, and 46 acres of third-year small grain stubble were searched with a nightlighting rig during September. Counts of night-roosting quail coveys and of cottontails were made while cruising the stubble fields.

More quail--18 coveys--were found in the first-year stubble than in the older fields. None were found in second-year stubble, and two coveys were flushed in third-year stubble.

Cottontails were found to be twice as abundant in second-year stubble as in first-year stubble, 0.8 rabbit per acre and 0.4 rabbit per acre, respectively. In third-year stubble, the count was 0.7 rabbit per acre.

The first-year stubble contains more bare ground than the older stubbles and is usually characterized by the occurrence of common ragweed (*Ambrosia artemisiifolia*), beggar's ticks (*Bidens* spp.), and, to a lesser extent, fall panicum (*Panicum dichotomiflorum*) and crabgrass (*Digitaria ischaemum*). Goldenrod (*Solidago* spp.) and white heath aster (*Aster pilosus*) become the dominant plants in older small grain stubbles, along with a decrease in the amount of bare ground. Management for upland game on public hunting areas should include acreages of both first-year and older small grain stubbles.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Results of booming ground surveys conducted in 14 areas in seven counties of south-central Illinois in the spring of 1973 revealed a total of 266 prairie chicken cocks. The 203 cocks in the Bogota flock comprised 76 percent of the known statewide total. Prairie chickens were found on 7 of the 13 areas surveyed outlying the Bogota area.

The flock between Kinmundy and Forbes Park contained 22 cocks this spring, in contrast to 12 cocks in 1972 and only 6 cocks in 1971. The flock between Farina and Forbes Park declined from 28 cocks in 1972 to 22 cocks. However, these 22 cocks, which are remnants of the once-widespread flock near Farina, are now localized on or in the immediate vicinity of the 100-acre Lacey Sanctuary and adjacent 40-acre Loy tract. The Kinmundy-Forbes population is anchored to the 160-acre Survey and 160-acre Butler sanctuaries. These two populations totaling 44 cocks in Marion County and the 203 cocks on or near the sanctuaries at Bogota in Jasper County thus constitute 93 percent of the known statewide population of prairie chickens.

A total of only 19 cocks were found in five areas where no nest sanctuaries are established. Declines between the springs of 1972 and 1973 were noted at Loogootee (6 cocks to 2 cocks), Hoyleton (5 cocks to 3 cocks), and Bible Grove (5 cocks to 4 cocks). Six cocks were censused during both springs at Mt. Erie. Four cocks were found near Fairman this spring compared with 3 cocks in 1972.

The data for the small colonies of prairie chickens outlying the Bogota Area demonstrate the tenacity of Illinois prairie chickens. Also, the data for the Kinmundy-Forbes flock demonstrate the low level to which prairie chickens can decline (6 cocks in 1971, but as low as 4 cocks in 1965) and still recover if the habitat is improved in time. So long as native prairie chickens are present on native range, it is probably never too late to save them from extinction if the proper management measures can be taken quickly enough.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois June, 1973 Vol. 16, No. 6

Manipulation of Pheasant Habitat

G. B. Joselyn

An undesirable aspect of attempting to draw nesting pheasants onto seeded roadsides is the possibility that some nests will be flooded, since one of the primary functions of roadsides is to provide a means of moving field runoff. Ten years of data from seeded plots at Sibley revealed that only a fraction of 1 percent of established nests were affected by flooding, so far as could be determined. During these years, runoff was very rarely of such volume during the late spring and early summer as to flood a significant number of roadsides.

Studies of pheasant nesting ecology, now under way on the Ford County Management Unit (FCMU), indicate that ditch bottoms and sometimes considerable portions of entire roadsides have been flooded during the several periods of heavy precipitation that have occurred in Ford County since the third week in May this year. Precipitation in Gibson City between 25 May and 20 June totaled 12.31 inches, which included three daily totals of nearly 2 inches. Observations on FCMU roadsides indicate that water flowed down many ditches with considerable force, no doubt covering some nests with debris or soil while scattering the eggs from some, making them impossible to locate during searching. Nevertheless, several nests that had been under water have been located, indicating that flooding may this year constitute a significant factor in nest destruction.

Ecology and Management of Squirrels

C. M. Nixon,
R. E. Greenberg

The present distribution of gray squirrels in Illinois was examined in relation to the distribution by county of forest habitat at the time of settlement (*circa* 1820).

About 60 percent of presettlement Illinois was prairie, with forests found mostly along streams and rivers and in the unglaciated southern and northwestern areas. Within the prairie, forests extending along rivers provided some habitat for gray squirrels, but most of these woodlands were occupied by fox squirrels. Gray squirrels were rarely found in east-central Illinois in what is now Ford, Iroquois, Livingston, Grundy, LaSalle, and McLean counties. It seems likely that fox squirrels were plentiful in areas where forest and prairie coexisted but were rare or absent in the heavily forested southern counties.

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Isolated (relict) populations of gray squirrels in towns and parks today may be the remnants of former wild populations. This assumption is open to challenge in that there are known cases of successful urban introductions of gray squirrels by man. However, where isolated areas of forest (in 1820) coincide with present distribution of pockets of gray squirrels (such as the "Big Woods" in the center of Champaign County), it seems reasonable to accept these squirrels as remnants of formerly abundant wild populations.

Continuous grazing and burning of many woodlots rendered them less suitable for gray squirrels, and the gray squirrel was becoming relatively scarce in the 1880's and 1890's. Today, gray squirrels are common only in the southern third of Illinois and in some of the heavily timbered river bottoms remaining in the central and northern part of the state.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

The prebreeding census of quail was conducted on the Dale and Forbes areas in early March 1973. On the Forbes Area, 11 coveys containing 102 quail (4.2 quail/100 acres) were recorded during the census. This prebreeding estimate was 12 percent lower than the prebreeding estimate made in 1972 and was only slightly lower than the long-term mean, 4.4 quail/100 acres, for the prebreeding populations. Estimates of the prebreeding populations on Forbes have ranged from 1.9 to 7.3 quail/100 acres.

On Dale, 10 coveys with 114 quail were observed during the prebreeding census in March. This estimate of 10.4 quail/100 acres was 35 percent greater than the prebreeding estimate for the previous year and 30 percent greater than the long-term mean for the prebreeding populations. The estimates of the prebreeding populations have ranged from 3.5 to 12.0 quail/100 acres.

Winter losses on the Forbes Area in 1972-73 totaled 82 percent of the estimated fall population; on Dale, winter losses totaled 73 percent. Overwinter losses of similar magnitude have been recorded during previous years. Hunting accounted for most of the mortality among the populations.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

During the spring of 1973, 405 people (in contrast to 301 in 1972) visited the prairie chicken sanctuaries in Jasper County on a reservation basis. In addition, an unknown number of people without reservations visited the Bogota area and watched the courtship display from roadsides instead of from blinds on the booming grounds. Forty groups representing 27 different universities, colleges, high schools, clubs, or other organizations and agencies were involved on 26 mornings this spring. Academic groups represented included the following: Miami University (Ohio), 38 individuals; Indiana University, 23; Southern Illinois University, 20; Western

Illinois University, 18; University of Illinois, 11; University of Louisville (Kentucky), 10; Northern Illinois University, 9; Illinois State University, 4; Earlham College (Indiana), 61; Greenville College, 13; Quincy College, 12; Bethany High School, 15; and Centerville Senior High School (Indiana), 7. Other groups represented included the following: Illinois Audubon Society, 21; Webster Groves Nature Study Society (Missouri), 20; Prairie Chicken Foundation of Illinois, 19; Thorn Creek Audubon Society, 15; Champaign County Audubon Society, 15; Evansville (Indiana) Audubon Society, 12; Lancaster County (Pennsylvania) Bird Club, 12; The Nature Conservancy, 11; Illinois Natural History Survey, 9 (not including project field personnel); Illinois Agricultural Association, 5; C.B.S. TV News, 4; Illinois Department of Conservation, 3; Bureau of Sport Fisheries and Wildlife, Patuxent, Maryland, 2; National Audubon Society, 1; and 16 other photographers and interested individuals. Most of these visitors (particularly university and college groups) were a distinct aid to the research project by recording their observations while in the blinds. All groups were closely supervised in order to keep harassment of prairie chickens on booming grounds to an absolute minimum. The prairie chickens at Bogota thus provide a unique learning experience and recreational opportunity for Illinoisans and for visitors from other states.

~~cat.~~ Mrs. Dodds

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois July, 1973 Vol. 16, No. 7

Manipulation of Pheasant Habitat

G. B. Joselyn

Throughout the prime pheasant range of east-central Illinois, the timing and progress of annual farming activities can have a substantial impact on pheasant chick production in a given year, particularly in areas of intensive land use, where nearly 85 percent of farmland (or more) is in row crops. The remaining land--in oats, hay, pasture, and nonagricultural use--produces the bulk of pheasant chicks. Data from the Sibley Study Area show that of these cover types, hay and roadsides now produce the great majority of all successful nests (nearly 80 percent in 1972). Thus, any change in normal farming activities that delays hay harvest or roadside mowing can benefit incubating hens by allowing them sufficient time to complete the hatch.

This year, wet weather has delayed planting and cultivation throughout east-central Illinois. Some soybean cultivation was still going on in the Sibley Area during the last week of July. These conditions have resulted in a noticeable delay in the harvest of hay and in the mowing of roadsides. Thus, a substantially greater proportion of available nest cover has remained standing throughout much of the Illinois pheasant range in 1973 than is normally the case.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Intermediate timber harvests, those made between the time the timber stand is reproduced and the next harvest cut, constitute the most common type of timber cutting used in Illinois. In this type of cutting, trees, either alone or in small groups, are cut to improve species composition and to control spacing of future crop trees. The immediate and long-term effects of these cuts, on squirrels and other forest wildlife, are at present undetermined. Studies that seek to determine how these intermediate timber cuts affect squirrels are now under way, using several study areas scattered throughout Illinois.

The first area selected for study, known as the Massac Tower Area, is located in a 44-acre mixed hardwood stand in Pope County, Illinois. This area will be cut during the fall of 1973. Estimates of squirrel densities, counts of possible den sites, and estimates of food production in fall will be determined on the area prior to timber cutting and for 2 years postcutting.

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The timber sale will remove 761 trees and reduce the basal area from the present 82 ft^2 to 57 ft^2. Based on counts of possible nest dens now available, the timber sale will remove 40.8 percent of the squirrel nest sites. If cull trees are also removed by the operator, up to 72.4 percent of the available nest dens will be removed during the sale.

Estimates of squirrel density ranged from 48 to 52 squirrels on the 44-acre area, based on 10 days of livetrapping undertaken in late May 1973. There were 25 individual squirrels actually tagged during live-trapping, 15 gray squirrels and 10 fox squirrels.

Responses of Bobwhites to Habitat Manipulation — J. A. Ellis

The mean numbers of bobwhite calls recorded per stop along standardized audio-census routes on the Forbes and Dale areas have been used as indices of fall population densities (MWRL 12(9):2) on these areas. Analysis of data for 1964-72 showed significant regressions ($P < 0.005$) between the numbers of bobwhite calls per listening stop and the prehunt population estimates obtained by censuses with bird dogs. Predicted population levels for fall 1973, based on these regression formulae, are 33.9 and 25.1 quail per 100 acres for Dale and Forbes, respectively. These estimates represent a 15 percent increase in the prehunt density on Forbes and an 18 percent decrease in the prehunt density on Dale, compared with the estimates made in 1972.

The unusually abundant rainfall during May and June was thought to have disrupted nesting activity, particularly on the Dale Area. The peak of whistling activity and the greatest trap response by males to cock-and-hen trapping usually occur the third week of June. I believe that these reactions by the males at this time are related and are due to nest attendance--probably incubation--by a majority of the hens. This year, however, the peak of whistling occurred the first week of July, and the greatest trap response by males occurred the first week of June.

Responses of Prairie Chickens to Habitat Manipulation — R. L. Westemeier, D. R. Vance

During the 10-year period of 1963 through 1972, hatching success of prairie chicken nests on sanctuaries at Bogota has averaged 66.9 percent. Annual variations have ranged from a low of 57.1 percent in 1967 (sample of 7 nests) to a high of 100.0 percent in 1966 (5 nests). Our data are limited for the period of 1963 through 1969; however, hatching success amounted to 66.1 percent in 1970 (63 nests), 66.7 percent in 1971 (62 nests), and 64.9 percent in 1972 (86 nests). These levels of nest success are well above the level of approximately 50 percent or lower mentioned in the literature for other states.

This summer, however, we are documenting a drastic reduction in nest success on the sanctuaries at Bogota. As of 20 July 1973, hatching success among the 65 nests located on the Bogota sanctuaries is only 24.6 percent. Forty-four (91.7 percent) of the 48 unsuccessful nests this year were destroyed by predators.

Recent departures from normal weather patterns may have contributed significantly to the high level of predation on nests. Cover development in 1972 was poor, due to drought conditions that year. Conversely, rainfall was excessive during the past winter, spring, and early summer. Residual cover, which is vitally important to nesting prairie chickens, was badly flattened or lodged at nesting time this spring, and the near-constant wetness and flooded conditions apparently created excellent scenting conditions for mammalian nest predators. Nests this year tend to be on the highest or best-drained sites on the sanctuaries, and nest bowls are constructed of unusually deep layers of grassy duff, often in relatively exposed cover situations.

Two management implications can be emphasized by this year's poor nesting season. First, efforts should be made to promote good drainage in nest grasslands; and second, steps should be taken to minimize mammalian predator habitat, particularly den sites, on sanctuaries.

Ireat. Mrs. Dodds

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | August, 1973 | Vol. 16, No. 8

Manipulation of Pheasant Habitat

G. B. Joselyn

Studies of pheasant nesting ecology on seeded and on unseeded roadsides have been under way since 1963. Data collected over the past 10 years show that (1) the establishment of pheasant nests on roadsides seeded to a grass-legume mixture and left unmowed occurs at a rate nearly 2.5 times the rate of establishment on unseeded roadsides where mowing is not controlled; (2) successful (hatched) pheasant nests occur on seeded roadsides at a rate 2.7 times the rate of occurrence on unmanaged roadsides; (3) unmowed seeded roadsides give substantial weed control and are aesthetically acceptable to farm operators; (4) the longevity of seedings is at least 10 years; and (5) as demonstrated by two pilot projects, extensive programs of seeding roadsides appear to have excellent potential for pheasant management.

At this point in our studies, there appear to be three possible approaches to management of roadside cover over a large area that would involve the seeding of roadsides: (1) seedings of roadsides graded as part of the ongoing road-maintenance work of townships and counties; (2) seedings of roadsides at the request of individual farm operators; and (3) block seedings of all roadsides in designated townships or parts of townships.

The known or presumed advantages and disadvantages of each approach will be discussed in subsequent reports.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Two subspecies of gray squirrels supposedly occur in Illinois. *Sciurus carolinensis carolinensis* exists in the densely timbered areas in approximately the southern one-third of the state, and *Sciurus carolinensis pennsylvanicus* occurs in the remaining extensively forested areas in central and northern Illinois.

An attempt was made to distinguish *S. c. carolinensis* from *S. c. pennsylvanicus* on the basis of biochemical differences. Electrophoresis (the separation of molecules with different electrical charges in an electric field) was used to examine 12 different proteins from various organs in samples of five Illinois gray squirrels from the *S. c. carolinensis* range (Pope County) and five from the *S. c. pennsylvanicus* range (Jo Daviess County). For a basis of comparison, samples of five *S. c. carolinensis* and five *S. c. pennsylvanicus* collected from their type localities, North Carolina and Pennsylvania, respectively, were also electrophoretically examined.

Results of the electrophoretic experiments disclosed that there were no differences in the proteins examined between the northern and southern Illinois squirrels nor between the North Carolina and Pennsylvania squirrels. The genetic alleles, which determine the nature of the proteins, were the same in the southern and northern Illinois squirrels, and, likewise, were the same in the North Carolina and Pennsylvania specimens. It appears that natural selection is favoring the same alleles at the gene loci examined in the two subspecies of polygamous gray squirrels. However, the biochemical differences in the two subspecies appear to be subtle, and the sensitivity of electrophoresis may not be great enough to detect such differences.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

Food items found in the crops of quail harvested on the Dale and Forbes areas in 1971 were identified, and the volumes of all seeds except acorns (*Quercus* spp.) were determined. Seeds of 34 species of plants were found in 150 crops obtained from the Dale Area in 1971. The 10 most important species listed in order of decreasing volume of seeds consumed were: soybean (*Glycine max*), Korean lespedeza (*Lespedeza stipulacea*), wheat (*Triticum aestivum*), buckwheat (*Fagopyrum esculentum*), jewelweed (*Impatiens pallida*), common ragweed (*Ambrosia artemisiifolia*), corn (*Zea mays*), tick clover (*Desmodium* spp.), wild bean (*Strophostyles* spp.), and beggar-ticks (*Bidens* spp.).

Thirty-three species of seeds were identified in the 194 crops from the Forbes Area. The 10 most important foods listed in order of decreasing volume consumed were: wheat, corn, Korean lespedeza, cow pea (*Vigna sinensis*), soybean, common ragweed, tick clover, foxtail (*Setaria* spp.), jewelweed, and lance-leaf ragweed (*Ambrosia bidentata*). Although volumetric measurements were not made of acorn fragments because of the instability of the fruit in the crops of quail, acorn fragments were found in 25 percent and 22 percent of the crops from the Forbes and Dale areas, respectively. This high degree of frequency of occurrence would have placed acorns among the top 10 foods on both areas had it been possible to make volumetric measurements.

The bobwhite feeds on a variety of plant seeds during November and December. The bulk of the diet is supplied by seeds of plants associated with the early stages of secondary succession and by seeds of agricultural crops. In samples from Forbes and Dale, agricultural seeds comprised 88 percent and 63 percent, respectively, of the total volumes among the top 10 food items consumed. Thus, quail on the Dale Area relied more on native food items than did quail on Forbes.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Redtop (*Agrostis alba*) continues to be the basic grass used to provide quality nest cover on prairie chicken sanctuaries in Illinois. Timothy (*Phleum pratense*) has also proven to be an attractive cover for nesting hens, but the

low commercial value of timothy seed ($0.05-0.22 per lb) has made it difficult to interest local farmers in harvesting the seed. Thus, small quantities of timothy (and legumes) are added to new redtop seedings to diversify the resultant cover for nesting hens, but timothy and legumes are not seeded in pure stands. Using self-propelled combines to harvest grass seed results in a 10- to 14-inch stubble that withstands the weather and stays erect for the next nest season. The grass stubble permits easy visibility for a standing prairie chicken, yet provides ample concealment for nesting. The wheel tracks of a combine provide travel lanes, and the clipped culms, seed heads, and leaves provide openings in the sod and the necessary duff for nest material. Clipping for seed harvests is also desirable from the standpoint of weed and brush control on sanctuary land.

Combining of redtop grass seed offers significant economic as well as ecologic advantages to prairie chicken management. The economic aspect was particularly good this summer, as the market price reached $0.75 per lb in contrast to $0.52 per lb in 1972 and about $0.35 per lb in previous years of this project. Yields of 100 lb per acre are common; however, yields of approximately 200 lb per acre were achieved by several of our cooperating farmers on some of the newer seedings. Thus, the per acre income for a redtop harvest may be as much as $150.00. Customarily, the income from redtop seed harvests is shared on a 50:50 basis between local farmers and the Prairie Grouse Committee, Illinois Chapter, The Nature Conservancy. Because farmers are assessed for land taxes on the acres they combine on state-owned sanctuaries, they are granted 65 percent of the grass seed crop--35 percent becomes the state's share.

Some of our best prairie chicken production areas were also some of the best grass seed meadows. Redtop harvesting can, therefore, significantly defray the cost of sanctuary management.

Uncat,

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois September, 1973 Vol. 16, No. 9

Manipulation of Pheasant Habitat

G. B. Joselyn

The preceding MWRL (16(8):1) listed three possible approaches to management of roadside cover, over a large area, that would involve the seeding of roadsides: (1) seedings of roadsides graded as part of the ongoing road-maintenance work in townships and counties (Graded Roadside Program); (2) seedings of roadsides at the request of individual farm operators (Volunteer Program); and (3) block seedings of all roadsides in designated townships or parts of townships (Block Seeding Program).

The potential of the Graded Roadside Program appears to be substantial. In most townships throughout the prime pheasant counties, several miles of roadsides are graded each year in the course of routine maintenance. Generally, grading is done preparatory to applying bituminous material to gravel, oiled earth, and dirt roads that are maintained by townships. Grading renders most of these roadsides virtually useless as pheasant nest habitat for several years, the length of time depending upon previous vegetative cover, the depth of the grade, and other factors. Only those few miles of roadsides along county-maintained roads are reseeded after grading. Along township roads (these constitute the bulk of graded roadsides in most counties), where reseeding is generally not undertaken, soil erosion and weed problems are evident for several years after grading.

There is good evidence that substantial acreages of graded roadsides are annually available for management. County Superintendents of Highways in five east-central Illinois counties (Champaign, Ford, Iroquois, Livingston, and McLean) were queried in late 1971 regarding the acreage of graded roadsides in these counties. Combined estimates from these officials indicate that about 180 to 215 miles of road are graded on both sides <u>each year</u> in these five counties, or 360 to 430 miles of roadside (720 to 860 acres) per year. Furthermore, since the upgrading of existing roads is an ongoing program (done as funds become available), similar acreages will be graded each year for the next several years. We do not know to what extent grading is carried on in other counties. No doubt many other counties have similar programs, but some may not, making projections to additional counties somewhat tenuous. Nevertheless, a rough projection to a nine-county area including Douglas, Macon (north half), Piatt, and Vermilion counties, in addition to the five named above, indicates a potential annual availability of 750 miles of graded roadsides (1,500 acres). This acreage represents an estimated annual availability of 3.7 percent of the total area of rural roadsides in these counties (highway roadsides excluded).

The next report will discuss advantages and disadvantages of the Graded Roadside Program.

NATURAL HISTORY SURVEY

1973

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Illinois has been arbitrarily divided into 14 subregions as an aid in determining the present distribution and abundance of the gray squirrel. Counties were grouped together on the basis of drainage patterns, using squirrel abundance and the degree of forest cover remaining in a county as criteria.

Forest cover was found to be decreasing in eight subregions, static in one subregion, and increasing in five subregions, all in southern Illinois.

The greatest increase in forest cover--14.9 percent between 1948 and 1962--occurred in the eight-county basin of the Embarras River. The greatest decrease in forest cover--17.9 percent, 1948-62--occurred in the six-county basin of the middle Mississippi River. Forest cover in the Kaskaskia River basin was essentially unchanged during this 12-year period, but, with the creation of Lake Shelbyville, forest cover in the upper basin has declined since 1962.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

The above-normal rainfall from February through May affected research plans, crop rotation schedules, and possibly the quail populations on the Dale and Forbes areas in 1973. Forty acres were scheduled for prescribed burning in either February or March in the experimental management zone on the Dale Area. On three different occasions, attempts were made without success to burn the tract. We were successful in burning four or five tracts on the Forbes Area. These fires were "cool" and did not accomplish the desired results.

The delayed planting season eliminated oats scheduled for six plots in the experimental management zone on Forbes. These plots were in corn in 1972 and had been limed and fertilized with rock phosphate. The fertility of the plots, plus the abundant rainfall during the early part of the growing season, resulted in rank stands of mostly annual weeds such as common ragweed (*Ambrosia artemisiifolia*), cocklebur (*Xanthium commune*), red clover (*Trifolium pratense*), goldenrod (*Solidago* spp.), sweet clover (*Melilotus* spp.), foxtail (*Setaria* spp.), and mare's tail (*Erigeron canadensis*). In some instances common ragweed was more than 6 feet tall. Such vegetative conditions are not conducive to quail abundance.

Corn was scheduled for six plots on Forbes. Because of the delayed planting season, the sharecropper seeded soybeans instead of corn on four of the six plots. We prefer corn as a row crop because corn is not as hard on these soils as beans, and corn stubble provides more overwinter cover than bean stubble.

My observations on Forbes, plus those of park employees and other Department of Conservation personnel, indicate that there are fewer quail broods this year than in 1972. However, audio-censuses on Forbes predicted higher populations for the fall of 1973 than in 1972.

<u>Responses of Prairie Chickens to Habitat Manipulation</u>

R. L. Westemeier,
D. R. Vance

In a preliminary assessment of the nesting season of 1973 (MWRL 16(7):2), we noted a drastic reduction in nest success on the sanctuaries at Bogota. Of the total of 83 prairie chicken nests found this summer, 3 were atypical and 6 were of unknown fate. Of the remaining 74 nests of known fate, only 23 were successful, 50 were destroyed, and 1 was abandoned. The success level of 31.1 percent was the lowest recorded in the 11 years of this study. Nest success averaged 66.9 percent (range, 57.1 to 100.0 percent) during the past 10 years (1963-72).

Predation accounted for 67.6 percent of the nests of known fate. The predation rate for the previous 10-year period averaged 28.5 percent (81 of 284 nests). Abnormal weather conditions, as discussed in MWRL 16(7):2, are believed responsible for this high predation rate; they may also be responsible for a few prairie chickens being hatched on private land. Prolonged wet soil conditions prevented or delayed most spring plowing and promoted luxuriant growth of pastures. As a result, much more nest cover was available on private land than in past years. We can not accurately evaluate the effect of this abnormal nesting season on the population level of prairie chickens at Bogota until the booming-ground census in the spring.

Mrs Dodds

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | October, 1973 | Vol. 16, No. 10

Manipulation of Pheasant Habitat

G. B. Joselyn

The preceding two reports (MWRL 16 (8,9)) outlined three possible approaches to management of roadside cover, over a large area, that would involve the seeding of roadsides (Graded Roadside Program, Volunteer Program, Block Seeding Program) and discussed the potential of the Graded Roadside Program. This report presents the known or presumed advantages and disadvantages of the Graded Roadside Program.

Advantages

(a) Sizable acreages of annually graded roadsides appear to be available throughout the prime pheasant range.

(b) Experience in seeding graded roadsides in Ford County shows that a high degree of cooperation can be expected from farmers and from maintenance officials of township and county roads. Cooperation with maintenance officials is probably enhanced because erosion and problems of weed control are mitigated by seedings.

(c) Because of the potentially wide area to be covered, many different farmers and governmental units would be brought into contact with the program, which could have a positive public relations value for the Department of Conservation.

(d) Managers of roadside cover can retain some degree of control over the intensity of their operations, as dictated by availability of funds, because seedings need be applied only in predetermined townships.

(e) The most significant advantage is that the seedings would promptly replace (at least partially) the usual low-quality nest habitat that is being destroyed by grading operations. If the graded roadsides are left unseeded, it will be several years before even inferior nest habitat develops.

Disadvantages

The primary disadvantage of this program is that graded roadsides are widely scattered.

(a) Experience has shown that there are approximately 1.3 farmers per mile of roadside (one side) to be contacted before seedings can begin. It is difficult and time consuming to find out who farms the land adjacent to each parcel of roadside selected for seeding and where these individuals reside, so that contacts can be made for permission to proceed. Another problem--the difficulty of actually locating these individuals--is greater where roadsides to be treated are farther apart.

(b) A similar, although less difficult, problem is that of making and keeping contact with the various governmental units involved.

(c) The seedings of graded roadsides in Ford County in September 1972 demonstrated the logistical problems of moving men and equipment over a large area.

(d) Seeded roadsides scattered throughout a county greatly increase the cost and effort involved in placing and maintaining signs to inform the public why the roadsides remain unmowed.

(e) Contacts with cooperating farmers to encourage adherence to delayed mowing agreements are made more difficult with widely spread seedings.

(f) The impact of scattered seedings on pheasant abundance would be less apparent than where most or all roadsides in an area were seeded.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

In recent years, gray squirrel habitat has been declining in northern Illinois. Correlation analysis was used to determine the relationship of the percentage of gray squirrels in the total squirrel harvest to selected timber indices. The proportion of gray squirrels in the squirrel harvest for each county in the combined hunting seasons of 1956-57 and 1971-72 were compared with timber statistics for 1962 and 1967. The highest correlations with the gray squirrel harvest were with the percentage of total county area forested in 1962. These correlation values were $r = +0.82$ ($\underline{P} < 0.001$) for the 1956-57 seasons and $r = +0.78$ ($\underline{P} < 0.001$) for the 1971-72 seasons ($N = 102$). The percentage of grays in the squirrel harvests for both 1956-57 and 1971-72 was negatively correlated ($\underline{P} < 0.01$) with the percentage of county forest grazed ($N = 102$) and positively correlated ($\underline{P} < 0.01$) with the number of thousand board feet of hardwood sawtimber per county ($N = 75$).

Multiple regression equations comparing the percentage of gray squirrels in the total 1956-57 harvest (Y) with the percentage of county area in timber during 1962 (X_1) and the percentage of county timber grazed in 1967 (X_2) were formed. The multiple regression equation for the percentage of grays in the total county squirrel harvest in 1956-57 is $Y = 9.39 + 1.41X_1 - 0.113X_2$. This equation is significant ($\underline{P} < 0.001$), has a multiple correlation of +0.83, and accounts for 68 percent of the variance in the gray squirrel harvest. The multiple regression equation for the percentage of gray squirrels in the 1971-72 squirrel harvest on a county basis is $Y = 15.9 + 14.4X_1 - 0.174X_2$. This equation is also significant ($\underline{P} \leq 0.001$), has a multiple correlation of +0.79, and accounts for 63 percent of the variance in the gray squirrel harvest.

It appears that gray squirrels exist in counties that have a high percentage of forest that is relatively undisturbed by livestock grazing or human influences. Reduction of timber acreages or the "opening up" of woods will cause the gray squirrel population to decline and the fox squirrel population to increase.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

Wings from 245 quail harvested in 1972-73 on the Dale Area were sexed and aged according to plumage characteristics. Juveniles comprised 80 percent of the sample. The percentages of cocks among the adult and juvenile segments were 56 and 49, respectively. The young:adult hen ratio was 9.4:1.

Seventy-eight percent of the 316 wings comprising the sample from Forbes in 1972-73 were juveniles. Sixty-five percent of the adults and 51 percent of the juveniles were cocks. The young:adult hen ratio was 10.3:1.

These sex and age data from the 1972-73 harvest deviate slightly from the long-term mean for 8 years, 1964-71. More than 2,000 wings from each area were examined during that period. Juveniles comprised 85 percent of the sample from Dale. Sixty-three percent of the adults and 49 percent of the juveniles were cocks. The young:adult hen ratio was 18:1.

Juveniles comprised 82 percent of the sample from Forbes. The percentages of cocks among the adult and juvenile segments were 60 and 51, respectively. The ratio of young per adult hen was 12:1.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

During the 10-year period of 1963-72, the rate of predation and abandonment of prairie chicken nests at Bogota ranged from 7.1 to 50.0 percent, with a mean of 34.2 percent for 310 nests of known fate. (Nest losses due to farm activities are excluded in this report.) Among 106 unsuccessful nests found during this period, 86 (81.1 percent) were found destroyed by predation and 20 (18.9 percent) were judged to have been abandoned. The estimated number of eggs per unsuccessful nest ranged from 1 to 14 and averaged 5.4 for the 1963-72 period.

In 1973, however, 73.0 percent (54 nests) of all nests found were unsuccessful due to predation or abandonment. About 93 percent of the unsuccessful nests were destroyed by predators. The mean number of eggs per unsuccessful nest in 1973 was estimated as 7.2 and ranged as high as 16 eggs.

The rate of predation and abandonment of nests in 1973 was over twice as high as the mean for the preceding 10 years. Predation or abandonment in 1973 occurred at later stages of laying or incubation than were average for 1963-72. Possible reasons for the poor nest season of 1973 were discussed in the previous report (MWRL 16(9):3). Between 1963 and 1969, hen kills were recorded at only 2 of 33 nests (both in 1964) that were unsuccessful because of predation or abandonment. In 1970, 1972, and 1973, hen kills were noted at 23.8 percent, 18.8 percent, and 13.0 percent, respectively, of the nests that were unsuccessful due to predation or abandonment. Thus, predation on nesting hens per se has increased to noteworthy levels during the past 4 years and does not appear exclusively related to factors responsible for the poor nest season of 1973.

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois November, 1973 Vol. 16, No. 11

Manipulation of Pheasant Habitat

G. B. Joselyn

The last report (MWRL 16 (10)) listed known or presumed advantages and disadvantages of the Graded Roadside Program for establishing cover for nesting pheasants. This report discusses the potential, advantages, and disadvantages of a second approach to roadside management, the Volunteer Program.

Potential

Under the Volunteer Program, farmers would request the Department of Conservation to seed their roadsides and would agree to delay mowing until late summer. Farmers would be informed of the program by the Department through various media. After a request by the farmer, biologists of the Department would inspect the roadsides to determine their suitability for seedings, would then schedule the seedings if they were feasible, and would conclude the delayed mowing agreement with the farmer.

Advantages

(a) This approach should induce a high degree of compliance with delayed mowing agreements because only interested farmers would make requests for seedings.

(b) If the program is properly presented to the farm community, many individuals would participate. As with the graded roadsides, farmers and governmental officials over a wide area would be brought into contact with the program.

(c) A maximum amount of public exposure to a sound program initiated by the Department would result from the advertising used to explain the program.

Disadvantages

(a) Conceivably, the greatest disadvantage to this approach could be the inability of managers to control the flow of requests from farmers for seeding. The county appears to be the smallest unit for which a reasonable degree of control could be imposed, in an advertising campaign. Maintaining program credibility would necessitate positive planning to insure that requests were acted upon within a reasonable time.

(b) As with the Graded Roadside Program, volunteer participants that are widely scattered would result in difficult logistical problems connected with field operations and in thinly spread seedings.

(c) The Volunteer Program would require the greatest public relations effort of the three seeding programs under consideration.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Two study areas on the Vermilion River Observatory near Danville were live-trapped for 10 consecutive days during late October 1973 to determine the size and composition of the squirrel population on each study area. Area A, 70 acres in size, has had nest boxes in place since March 1972; Area B, 60 acres in size, has no nest boxes. Estimates of population size were made for each area, using squirrel capture frequencies provided by the 10-day livetrapping period.

Estimates indicate that populations have increased about 10 percent on Area A and remained static on Area B since boxes were placed on Area A.

The number of young-of-the-year squirrels per adult female captured in live traps each fall has remained about the same on Area B but has doubled on Area A since box placement. However, young-of-the-year have been more abundant on Area B each fall.

An additional response of the squirrel population to nest boxes has been an apparent increase in the number of gray squirrels on Area A since the placement of boxes on the area. Gray squirrels made up less than 10 percent of the squirrel population on the area in 1971 but now comprise nearly 20 percent of the trapped population and are frequently seen throughout the area. Whether this increase is due to nest boxes or to a general increase in gray squirrels along the Vermilion River is not known as yet, but gray squirrels have not increased on Area B during our study.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

Censuses of quail were made on the Forbes and Dale areas in late October and early November to determine the prehunt densities. Thirty-three coveys, 512 birds (21.0 quail per 100 acres), were observed on Forbes. The prehunt estimate for Forbes this year was 8 percent lower than the prehunt estimate for 1972, 22.8 quail per 100 acres. The prehunt estimate in 1973 was, however, 7 percent greater than the long-term mean for prehunt estimates, 20.3 quail per 100 acres, and represented an increase of 400 percent from the estimated prebreeding population in 1973, 4.2 quail per 100 acres.

Twenty-three coveys containing 361 quail (32.8 per 100 acres) were observed on the Dale Area during the prehunt census this year. The prehunt estimate was 15 percent lower than that of 1972 (38.7 quail per 100 acres), was 2 percent below

the long-term mean for the prehunt estimates (33.6 quail per 100 acres), and represented an increase of 215 percent from the prebreeding estimate (10.4 quail per 100 acres).

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

The electrical power generating complex now under construction in Jasper County by Central Illinois Public Service Company (CIPS) appears to have considerable potential for prairie chicken management provided a cooperative program can be agreed on. The CIPS project involves about 8,000 acres immediately west of the Bogota Study Area, about 2,000 of which will become a lake for steam and cooling purposes. The plant site, coal and ash storage areas, flume, railroad yard, transmission lines, dam site, and related facilities will occupy much of the 6,000 acres of upland. Also, much of the upland area surrounding the lake is unsuitable for prairie chicken management due to extensive tracts of oak-hickory forest and rough topography. However, through the use of new (1972) aerial photos, topographic maps, soils maps, and cover-mapping in the field, four management units were delineated as possible prairie chicken management areas. The four units range in size from 130 acres to 470 acres, more or less, depending upon the scope of management implemented. Each unit lies adjacent to extensive areas of privately owned prairie farmland. The four units total about 1,000 acres and thus have the potential for doubling the present sanctuary acreage of 1,000 acres in Jasper County.

About 560 acres of cropland in the four units are suitable for a redtop (6 to 8 years) - soybean (1 year) - oats (1 year) - redtop (6 to 8 years) type of rotation. About 200 acres of rough but essentially open pastureland are suitable for continued grazing, but at a reduced intensity. At least 200 acres of woodlots are included in the proposed management units. An ideal arrangement would involve complete clearing of about one-fourth to one-half of the wooded acreage because of the hemming-in effect or psychological barrier they present to prairie chickens. The remaining woodlands should be scheduled for prescribed burning, selective basal spraying, and light grazing, which should eventually convert them to parklike savanna communities. Pasture areas should also be treated by periodic prescribed burning, selective basal spraying, and light grazing, and, in addition, an ideal treatment should include disking and seeding to native prairie grasses.

In addition to the four possible management units, a 5-mile right-of-way for power lines and a railroad is being constructed north and south between the main project area and the Illinois Central Railroad. This right-of-way is 110 yards wide, thus amounting to 40 acres per square mile or a total of 200 acres. The right-of-way extends through flat open prairie farmland, where some potential for prairie chickens can be envisioned if the strip were subject to grassland management.

To a large degree, the acceptance by CIPS of a management program for prairie chickens may depend on the amount of income that can be realized from cropping (redtop seed, soybeans, oats, grazing fees, hay, and similar activities). Most of the cropland on the CIPS area will be farmed for income on a sharecropping basis until the land is needed for purposes directly involved in production of electrical power. The income provided by typical cash-grain farming and moderate to heavy grazing would exceed the income produced by redtop farming, limited grain farming, and grazing. Also, it is not known whether the necessary funds and manpower could be made available for prescribed burning, control of woody vegetation, and prairie seedings.

One of the primary benefits to be gained by CIPS in establishing prairie chickens on their area would be an enhancement of their public image as an environmentally concerned company. On the basis of current population levels on the sanctuaries at Bogota, it seems likely that the proposed management units on the CIPS area could support a spring population of at least 100 prairie chicken cocks. This number of birds may not seem commensurate with the amount of habitat management necessary to establish them on the area. However, the more widely this native grouse can be established, the greater the chances for its ultimate preservation in Illinois.

Uncat.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois December, 1973 Vol. 16, No. 12

Manipulation of Pheasant Habitat

G. B. Joselyn

The last two reports (MWRL 16 (10 and 11)) listed known or presumed advantages and disadvantages of the Graded Roadside and Volunteer programs for establishing cover on roadsides for nesting pheasants in east-central Illinois. This report discusses the potential, advantages, and disadvantages of the third approach to roadside management, Block Seedings.

Potential

The Ford County Management Unit (FCMU) established in 1968 involved the seeding of most roadsides within and abutting on 16 square miles. This undertaking was highly successful; adherence of cooperating farmers to the delayed mowing agreement has been excellent. The success of the FCMU indicates that the Block Seedings Program would be equally successful.

Advantages

Block seedings would assure the highest level of control over the placement of seedings. This control constitutes the strongest argument for the Block Seedings Program.

(a) Seedings could be placed in those townships where it is judged the most benefits would be derived by pheasants.

(b) Time and expense in contacting farmers would be reduced to a minimum.

(c) Logistical problems in the operational phase of the program would be greatly diminished.

(d) The upgrading of maximum amounts of roadside habitat in a relatively small area should result in maximum benefits to pheasant population levels in that area. Comparative data on pheasant numbers on the FCMU before and after the seedings were established there seem to support this contention.

Disadvantages

Concentration of seedings in block situations restricts the number of counties and townships in which seedings can be established, thus reducing to a minimum the public relations benefits to the Department of Conservation.

NATURAL HISTORY SURVEY

JAN 10 1974

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

The availability of a plentiful crop of tree seed may be of critical importance in the survival, dispersal, or both, of summer-born gray squirrels during the post-weaning period. When tree seed crops are light, these juvenile squirrels may have difficulty competing with older, more experienced squirrels for a limited food supply.

The tree seed crop per acre was estimated for 9 years, using seed traps, on a public shooting area located within an extensive oak-hickory forest. The total seed crop was used as an independent variable (X) and was compared with the number of spring-born young shot per adult female (Y_1) and with the number of summer-born young shot per adult female (Y_2) the same fall in a multiple correlations analysis. The number of summer-born young shot per adult female (Y_2) was significantly correlated with the total seed crop the same fall ($r = +0.67$, $\underline{P} < 0.05$), but there was no significant correlation between the size of the seed crop and the number of spring-born young per adult female (Y_1).

Examination of the linear plot of the regression of the number of summer-born young shot per adult female on the seed crop suggests that the true relationship is curvilinear and that the rate of survival, dispersal, or both, of summer-born young is drastically reduced (survival rate) or increased (dispersal rate) when the seed crop falls below 130 pounds of sound seed per acre.

These data emphasize the importance of culturing a variety of seed producers over a range of sites to help reduce the possibility of a seed crop failure.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

It was possible to calculate survival rates of juvenile and adult males from fall to summer on the Dale and Forbes areas. The ratio of juveniles to adult males was determined from the harvested samples. The subsequent summer age ratios among subadult and adult males were obtained from cock-and-hen trapping.

Nine years of data have been examined for each area. For all years, juvenile males on the Dale Area exhibited a higher rate of survival than adult males from fall to summer. Similar results were noted on the Forbes Area in 6 of the 9 years.

Several factors were thought to influence this population phenomenon. Higher mortality among the adult male segment of the population could account for this differential survival. The higher ratios of subadult to adult males in the breeding season could be attributed to a behavioral difference between the two age-classes of males. Subadult males may be more mobile and trappable than adults, and adult males may be more territorial than subadults and less prone to capture by the cock-and-hen technique.

<u>Responses of Prairie Chickens to Habitat Manipulation</u>

R. L. Westemeier,
D. R. Vance

Sharecropping is our primary management tool on prairie chicken sanctuaries. In addition to accomplishing management objectives, sharecropping also helps minimize the costs of management by providing some income from the various crops produced (MWRL 15 (10):2-3). Income from crop harvest on state-owned sanctuaries is deposited in the state treasury. Income from state-owned sanctuaries in 1973 was $2,928.90. This total includes $91.05 from wheat, $1,862.33 from redtop and timothy seed (MWRL 16(8):3), $901.52 from soybeans, $50.00 from hay, and $24.00 from pasture.

Expenditures (not including cost of personnel) to date on state-owned sanctuaries were $1,080.54, including $356.25 for limestone, $137.50 for bulldozing, $404.00 for fencing, $7.79 for tractor parts, $65.00 for mowing weeds, and $110.00 for combining prairie grass seed.

Net income deposited in the state treasury as of this date is $1,848.36. Thus, in 1973, income from sharecropping has more than covered management costs on state-owned sanctuaries. Although management costs may not be exceeded by income in all years, we believe that management of prairie chicken sanctuaries can be a self-supporting operation on a long-term basis.

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois January, 1974 Vol. 17, No. 1

Manipulation of Pheasant Habitat G. B. Joselyn

Two of the three approaches to large-scale seeding of roadsides, discussed in the last four reports (MWRL 16 (8-11)), have been attempted in pilot programs--graded roadsides (throughout Ford County in September 1972) and block seedings (Ford County Management Unit during August and September 1968). Despite some logistical and equipment problems, the seeding of graded roadsides in Ford County clearly demonstrated the feasibility of such operations over a county-sized area. We continue to be pleased with results of the block seedings made on the FCMU. Evidence to date suggests that block seedings could constitute a reasonable and practical means of large-scale roadside seeding.

A volunteer program, in which the Department of Conservation would undertake seeding of roadsides at the request of individual farm operators, holds greater promise, I believe, than just the establishment of quality nest cover for pheasants and other prairie avifauna. Such a program could be patterned somewhat after the successful "Acres for Wildlife" in Nebraska and other states. As such, the Department would realize benefits in public relations and public education. Because the establishment of grass-legume cover on roadsides is a biologically sound management program with demonstrated benefits to wildlife, it offers the Department of Conservation a unique opportunity to incorporate the principles embodied in roadside management into a program of positive public relations and educational value.

All three approaches to roadside management outlined above require personnel from the Department in at least the planning and coordination of field operations. Also, the Department would have to provide certain specialized equipment (seeders and rollers) for the actual seeding. It was hoped at the beginning of this study that farmers or sportsmen's groups could establish seedings with their own equipment, but it is now apparent that such a program is not feasible. Specialized equipment must be used to insure the greatest probability of success of the seedings and to keep the amount of roadside disturbance to a minimum. Neither individual farmers nor sportsmen's groups have such equipment. Department personnel need not perform all phases of the seeding operation--rather, their participation should be kept to a minimum, restricted to planning, coordinating, and supervising the seedings. Local farmers should be hired to operate the equipment. This approach was successfully employed during the seedings on graded roadsides in Ford County in September 1972. Although the possible role of sportsmen's groups in the overall program should be considered further, it is the current view that their participation would be limited to public relations.

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Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

A sample of 126 cooperating squirrel hunters from the Southern Zone were sent questionnaires asking their preferences for opening and closing dates for the squirrel hunting season and for the size of the daily bag limit (four, five, or six squirrels). A total of 88 hunters returned their questionnaires.

Over one-half of the hunters (54.5 percent) approved of the August 1 opening date, but the remaining opinions ranged from June 1 to September 1. Only 17.0 percent wanted the season to open before August 1, and 83.0 percent felt that the squirrel season should open August 1 or later.

Hunter opinions on closing dates were more variable than on opening dates, with preferred closing dates ranging from September 15 to December 31. Less than one-half of the hunters were satisfied with the present closing date, November 15, and nearly 41 percent wished to close the season on November 1 or earlier. Only 11.3 percent wished to continue hunting squirrels after December 1.

Hunters in the Southern Zone seem to be generally satisfied with the present bag limit of five squirrels (63.6 percent approval), with only 8.0 percent favoring the six-squirrel hunt and 28.4 percent favoring a four-squirrel limit.

In summary, the majority of our sample of hunters from the Southern Zone prefer an August 1 or later opening date, with a closing date no later than November 15. Over 90 percent of these hunters oppose a six-squirrel bag limit.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

Harvest data collected on the Dale and Forbes areas during the upland game season of 1973-74 indicated a decline in the harvest of quail when compared with the season of 1972-73. On Forbes, 186 quail (7.6 per 100 acres) were harvested in 1973-74, a decline of 42 percent from the previous season (13.0 per 100 acres). The effort expended to hunt quail in 1973-74 declined 50 percent from the previous year.

On the Dale Area, 221 quail (20.1 per 100 acres) were harvested in 1973-74. This harvest total was 14 percent less than in 1972-73 (23.3 per 100 acres). The effort expended to hunt quail in 1973-74 was the greatest ever recorded on the Dale Area--1,027.5 gun-hours--13 percent greater than was recorded in 1972-73.

The January portion of the 1973-74 season, 22 percent of the total season, accounted for 16 percent of the harvest on Dale but only 5 percent of the harvest on Forbes. Weather conditions, snow and ice, made hunting unattractive during most of January.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Nesting by prairie chickens in plots in the second through sixth nest seasons after prescribed burning in March averaged 18.8 nests per 100 acres for the 5 years 1969-73 at Bogota. Only 3.4 nests per 100 acres were found during the nest season immediately following burning in March, although nesting in this category increased notably in 1973. Nesting in plots in the second through fifth nest seasons after burning in August averaged 23.6 nests per 100 acres. As with the March burns, limited nesting was noted during the nest season immediately following burning in August (4.0 nests per 100 acres). Thus far, there appears to be no clear pattern of declining densities of nests for up to the fifth (August) or sixth (March) nest season after a burn. Most of the burn and nonburn plots are dominated by redtop and timothy.

The mean nest density of 20.5 nests per 100 acres for burned plots in the second through sixth nest season after burning in March or August was significantly greater ($P < 0.01$) than the density of 13.5 nests per 100 acres for similar but unburned fields that were in the second nest season, or later, after seeding. However, hatch success for 139 nests in the burned plots averaged only 48.1 percent, compared with 63.5 percent hatch success for 162 nests in the nonburn categories. Nest success was particularly poor in the March burn plots--40.5 percent of the nests hatched, compared with 56.3 percent in August burn plots. Nevertheless, from the standpoint of successful nests per 100 acres, burned plots (9.5 hatched nests per 100 acres) still exceeded the nonburn plots (8.2 hatched nests per 100 acres).

The reason rates of nest success are lower in burn plots than in nonburn plots is unknown. Because of the higher densities of nests in the burn plots, the lower level of hatch success may be a density-dependent phenomenon. It may also be related to the relatively small size (about 5 acres) of our burn plots or to the rotational schedule of prescribed burning that we are following.

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois February, 1974 Vol. 17, No. 2

Manipulation of Pheasant Habitat

G. B. Joselyn

Of the three possible approaches to management of roadsides in east-central Illinois, which were discussed in the last five reports (block seedings, graded roadsides, volunteer program), it is felt that initial efforts should be directed towards seeding graded roadsides. The graded program is recommended before the others primarily because graded roadsides represent a situation where nest cover is being destroyed. Given current land-use trends throughout the pheasant range in Illinois, it is obvious that attempts should be made to replace lost nest habitat where the opportunity arises.

Approval has been obtained **for** a Federal Aid Project (W-85-D) that calls for seeding of graded roadsides in a nine-county area over a 5-year period beginning in 1974. Subsequent reports will present details of this undertaking.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

A sample of 81 cooperating squirrel hunters from the Northern Zone were sent questionnaires asking their preferences for opening and closing dates for the squirrel hunting season and for the size of the daily bag limit (four, five, or six squirrels). A total of 49 hunters returned their questionnaires.

Over one-half of the hunters (57.1 percent) approved of the present September 1 opening date, while less than 30 percent (28.5 percent) wished to open the squirrel season earlier than September 1.

Hunter opinions on closing dates were not as clear-cut in the Northern Zone as they were in the Southern Zone (see MWRL 17:1). Opinions were evenly divided (about 35 percent for each) between a November 1 and a November 15 closing date. Less than 30 percent of the hunters wished to extend the hunting season beyond November 15.

A narrow (53.2 percent) majority of the hunters in the Northern Zone approve the five-squirrel bag limit, whereas 36.2 percent prefer a four-squirrel bag limit and only 10.6 percent approve a six-squirrel limit.

In summary, our sample of cooperating hunters from the Northern Zone seem to be aware of the dwindling forest habitat of northern Illinois and to be willing to limit their hunting efforts in order to preserve something of their sport. In general, they oppose an August opening date and favor season closure by November 15 and a bag limit of less than six squirrels.

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Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

The posthunt censuses of quail were conducted on the Dale and Forbes areas the last 2 weeks of January 1974. Weather conditions were generally good during this period, enabling dogs to locate and hold quail coveys. Twelve coveys containing 152 quail (13.8 per 100 acres) were located on the Dale Area. The posthunt estimate for 1974 was 16 percent greater than in 1973, 14 percent greater than the long-term mean for the area (11.8 quail per 100 acres), and represented a reduction of 58 percent from the prehunt estimate of 1973.

On Forbes, 15 coveys containing 142 quail were found during the posthunt census. The estimated posthunt density (5.8 quail per 100 acres) was 3 percent greater than the estimate for 1973, 17 percent lower than the long-term mean for the area (7.0 quail per 100 acres), and represented a decline of 72 percent from the prehunt estimate of 1973.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Three preceding reports (IWRL 16 (7, 9, 10)) outlined abnormal weather conditions and a high rate of predation as factors contributing to the poor nest success of prairie chickens at Bogota in 1973. A third and interrelated factor involved the food base of predators. During the searches for prairie chicken nests, data are recorded for quail, doves, rabbits, songbirds, and small mammals, which make extensive use of the sanctuaries. The numbers of nests, per acre, of bobwhites, meadowlarks, dickcissels, field sparrows, rabbits, and small mammals (prairie voles and southern bog lemmings) all showed sharp reductions in 1973 compared with the years 1966 through 1972. It was curious that the nests of red-winged blackbirds and ground-nesting mourning doves were about the same in number as in previous years. The nests of additional species were also recorded, but these sample sizes were too limited to be meaningful.

Thus, it appears that many of the staple foods of predators were in short supply in 1973, which therefore brought about more intensive utilization of the prairie chicken resource at Bogota.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois March, 1974 Vol. 17, No. 3

Manipulation of Pheasant Habitat

G. B. Joselyn

Of the three possible approaches to management of roadsides in east-central Illinois, discussed in previous reports, it is the judgment of the project leader and of personnel in the Department of Conservation that initial management efforts should be directed towards seeding graded roadsides. Approval has been obtained for a Federal Aid Project (W-85-D) that calls for seeding of graded roadsides in a nine-county area, comprising most of the prime pheasant counties, over a 5-year period beginning in 1974.

In the first 5-year span of the project, seeding operations will be under way in the nine designated counties by the third year. During the initial year, only those graded roadsides located in the counties of Ford, Iroquois (except the northeast quarter), Livingston, and McLean (east half)--estimated to be 250 miles (500 acres)--will be seeded. The second year, operations will be expanded to include the four counties mentioned above and two additional counties (Champaign and Vermilion), bringing the expected second-year management development to approximately 450 miles (900 acres). For each of the remaining 3 years, development will also include the counties of Douglas, Piatt, and Macon (north half). Seedings are expected to involve approximately 750 miles of roadside (1,500 acres) per year for the third, fourth, and fifth years of the project.

A full-time project leader, Dennis Kirkham, has been hired. In addition, the plan calls for 2 months of time annually from Conservation Representatives and 3 months annually from District Game Biologists.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

We are investigating the effects of nest boxes on a population of fox squirrels located on two 70-acre oak-hickory stands in Vermilion County, Illinois. Nest boxes have been in place on one tract, Danville A, since March 1972. Density of nest boxes ranges from 1 to 3 per acre on the area.

All nest boxes were checked for use by squirrels in January 1974. Squirrels were captured in 26 boxes. Twenty-four boxes contained only one squirrel and two boxes had two squirrels present when checked. Many additional boxes showed signs of recent use by squirrels. Fourteen additional boxes were used for raising litters during 1973.

In early February 1974, the boxed area was livetrapped for 4 days to provide a ratio of squirrels using nest boxes to squirrels using leaf nests or tree dens. A total of 22 squirrels were captured at least once, 13 of which (60 percent) had been captured in nest boxes during January 1974. Thus, more than half the squirrels on the area this winter are using nest boxes for shelter at least some of the time.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

To determine the proportion of juveniles among the quail harvests by week on the Forbes Area, the harvests were distributed by age according to the week of the hunting season for the years 1964-71. During this period, the Illinois quail season extended from the second week of November until the end of December, 7 weeks. The proportion of juveniles among the harvests ranged from 78 percent (fifth week) to 86 percent (fourth week). Juveniles comprised 83 pereent and 81 percent of the harvests during the first and seventh weeks, respectively. There was no significant difference in the proportion of juveniles among total harvests by week ($X^2 = 5.68$; ref. $X^2{}_{(6)}.10 = 10.6$). These data suggest that the ratio of juveniles to adult quail remained fairly constant during the hunting seasons on the Forbes Area. In most upland game species, the proportion of juveniles to adults decreases as the hunting season progresses.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

To date, 17 acquisitions totaling 1,460 acres (1,000 in Jasper County, 460 in Marion County) are being managed for prairie chickens. Acquisition is, however, only the first step, as most of the land acquired was intensively farmed cropland when purchased. Subsequent management involves a great deal more than just seeding the land to grass. Because prairie chickens require a diversity of early successional stages of grasslands for nesting and brooding and strategically located sites for booming grounds, a combination of sharecropping and prescribed burning is employed to provide these essential habitat components at minimal cost.

During 1973 the management of established nest-brood grasslands involved the following activities: Redtop and timothy seed harvest, 431 acres; prairie grass seed harvest, 19 acres; legume seed harvest, 5 acres; hay harvest, 84 acres; pasture grazed, 68 acres; mowing for weed and brush control, 228 acres; firelanes disked, 8.9 miles; prescribed burning in March, 96 acres; prescribed burning in August, 24 acres; and selective basal spraying, 8 acres.

Management to provide booming grounds and to develop new sods involved the following activities: soybeans, 124 acres; corn, 8 acres; milo, 16 acres; wheat, 72 acres; redtop seedings, 102 acres; legume seedings, 21 acres; prairie seedings, 12 acres; limestone applications, 30 acres; and long-term fertilizer applications, 46 acres.

Additional activities involved 0.75 mile of fence-building and 5.5 hours of bulldozing ditches and junk heaps. Most of the activities listed were accomplished through share agreements with local farmers or through contractual services. Net income from seed harvests, crops, hay, and grazing fees amounted to $15,741.04 for the Prairie Grouse Committee of the Illinois Chapter, The Nature Conservancy, which owns or leases 894 acres, and $2,928.90 for the Illinois State Treasurer from 567 acres owned by the Illinois Department of Conservation and dedicated as Illinois Nature Preserves.

Costs of management activities to both owners, including real estate taxes paid by the Prairie Grouse Committee, were well below the amounts of income. Thus, sanctuary management for prairie chickens is essentially a self-sustaining operation. Also, much of the management that is essential for prairie chickens can also produce food and fiber for people. From this standpoint prairie chicken management is unique, and this aspect is likely to become more important because of the mounting pressures of an increasing human population.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois April, 1974 Vol. 17, No. 4

Manipulation of Pheasant Habitat

G. B. Joselyn

Certain biases are inherent in ground counts of pheasants (spring roadside counts, summer brood counts) and in other indirect means utilized to estimate total numbers on the Sibley and Ford County Management Unit study areas each year. Such biases are caused by weather conditions that affect animal behavior, observability, or both, and by other conditions, such as status of crops, that affect observability. Yet the need is great for an accurate direct count of pheasants on these areas each year in order to evaluate trends in numbers of pheasants and to determine the effects of roadside management on the FCMU on population levels. The best means of direct enumeration is the aerial count conducted from a helicopter over deep snow. Although it is intended that an aerial count be made each year, snow conditions are seldom suitable for such an undertaking. During only 3 years since 1962 have snow conditions been right for aerial counts to be made (Table 1).

Area	Year	Date	Pheasants Observed	Pheasants per Square Mile
Sibley (36 square miles)	1963	Feb. 27-28	4,043	112
	1965	March 5	1,684	47
	1973	Dec. 22	2,226	62
FCMU (20 square miles)*	1973	Dec. 22	2,215	111

* Includes 16 square miles where seeded roadsides occur and 4 additional miles contained in the area 0.25 mile around outside edge of study area.

The count on the Sibley Study Area in 1963 coincided very nearly with the highest population ever experienced on that area; the count in 1965 antedated by 2 years the lowest population on the area in the past 20 years.

The first two counts occurred about 2 months later than the count in 1973; therefore, on a comparative basis, the latter count may be too high. Regardless of this possibility, the numbers of pheasants on the Sibley Study Area were still

relatively high in 1973, considering that between 1963 and 1973 nearly 80 percent of the prime nest cover (forage crops) on the area was lost. The results from the FCMU indicate an excellent winter population on that area. Even allowing for differences in census dates between 1963 and 1973, the population on the FCMU in December 1973 approaches that at Sibley during the years of peak population levels. It may be tempting to conclude that differences in numbers of pheasants between the two areas are results of the seeded roadsides on the FCMU, but such a conclusion must await further evaluation of population changes on the two areas.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Intermediate timber harvest is the selective cutting of single trees or small groups of trees to improve species composition and the spacing of future crop trees. Intermediate harvests are made between the time the timber stand is reproduced and the next harvest cut. Because intermediate cutting is the most common type of timber harvest in Illinois, we need to know the immediate and long-term response of forest wildlife to such timber harvests.

Studies are currently being conducted on two study areas in southern Illinois to determine the effects of intermediate timber cuts on squirrel populations. One study area, the Old Barn Sale Area, is located in Pope County, Illinois. It is a 34-acre mixed hardwood stand in the Lusk Creek drainage. The stand consists of 80- to 90-year-old red oaks, with good populations of hickory, tulip, and beech. This area will be cut in the late spring of 1974; 27 acres will undergo an intermediate cut and 7 acres will be clear-cut. The timber sale will remove 411 trees, constituting a total volume of 167,000 board feet.

Squirrel densities will be estimated and counts of possible den sites will be made on the area prior to timber cutting and for 2 years afterwards. Fall food production on the area will also be estimated.

The Old Barn Sale Area was livetrapped for 10 days in March 1974. Estimates of squirrel density ranged from 56.0 to 60.6 squirrels for the 34-acre area (1.6 to 1.8 squirrels per acre). There were 27 individual squirrels tagged during the trapping period, eight fox squirrels and 19 gray squirrels. Eight adult female squirrels were trapped and all were either lactating or pregnant, thus indicating a good winter breeding season.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

The prebreeding censuses of quail were conducted on the Dale and Forbes areas during the first 2 weeks of March 1974. Thirteen coveys containing 136 quail (12.4 per 100 acres) were located on the Dale Area. The prebreeding estimate for 1974 was 19 percent greater than in 1973, 55 percent greater than the long-term mean for the area (8.0 quail per 100 acres), and represented a 62 percent decline from the prehunt estimate of 1973.

On Forbes, 15 coveys containing 104 quail were located during the prebreeding census. The estimated density (4.3 quail per 100 acres) was 2 percent greater than the estimate for 1973, 2 percent lower than the long-term mean for the area (4.4 quail per 100 acres), and represented a decline of 80 percent from the pre-hunt estimate of 1973.

<u>Responses of Prairie Chickens to Habitat Manipulation</u>

R. L. Westemeier,
D. R. Vance

As in past springs, booming ground surveys were conducted this spring (1974) on the Bogota Study Area at no less than weekly intervals from mid-March through mid-April. These data were supplemented by observations recorded almost daily by visitors in blinds on three major booming grounds.

The peak count for each booming ground this spring revealed a total of 143 cocks on the Bogota Area, a decline of 29.6 percent from the peak count of 203 cocks in the spring of 1973; this was the first decline since the population began a steady increase from the low point of 37 cocks in the spring of 1968. The decline this spring can be directly attributed to the nesting effort of 1973, which was essentially a failure in reproduction. Our intensive nest study at Bogota in 1973 documented the lowest level of nest success (31.1 percent) in 11 years. As described in four preceding reports [MWRL 16 (7, 9, 10) and 17 (2)], 2 years of abnormal weather and its detrimental effects on nest cover, the reduced food base of predators, and a high rate of predation on nests were the main interrelated factors to which the poor hatch of 1973 was attributable.

Despite the population decline, improvements in the distribution of the flocks at Bogota were noted in two directions this spring. Four cocks boomed with up to 10 hens near the 80-acre Jamerson McCormack Sanctuary on the south edge of the study area this spring, compared with two cocks in 1973 and one cock (the first since acquisition of this 80-acre tract in 1965) in 1972. On the east edge of the study area, up to 12 cocks were observed on or near the 110-acre Joseph W. Galbreath Sanctuary (acquired and seeded in 1972), although a stable booming ground did not become established there this spring. Except for two minor booming grounds involving one to three cocks, all booming was located on or in close proximity to the other sanctuaries.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson, Editor

Urbana, Illinois May, 1974 Vol. 17, No. 5

Manipulation of Pheasant Habitat

G. B. Joselyn

The seeding of the Ford County Management Unit (FCMU) in August and September 1968 was accomplished with a machine called the Howard Rotaseeder. This unique machine is an import from England where its primary function is the renovation of pasture land. The machine consisted of a 70-inch rototiller fitted with special slot cutting blades (5-inch intervals) and a seed drill that provided a means of seeding directly into sod with a minimum of soil disturbance. This left a protective mulch that seemed to have distinct advantages in holding moisture for newly-planted seed. Another advantage of the machine was that the depth of the slots (and thus depth of seed placement) could be controlled with good precision. Because little soil was disturbed, a small tractor (40-50 horsepower at PTO) could be utilized to power the rotaseeder. The machine was modified so that it could seed both brome and alfalfa at the same time; a roller to compact the seedbed followed the Rotaseeder. Overall, the machine did a credible job of seeding (as indicated by the results) and the concept of seeding directly into sod with a slot cutting machine was demonstrated.

The machine did, however, have drawbacks. The 8-foot overall width proved too wide for many backslopes and foreslopes along roadsides. The ground-drive wheel mechanism that operated the seed box caused considerable trouble and the rate of seed application was difficult to control.

When it came time to obtain additional equipment for seeding operations on project W-85-D, an attempt was made to locate machinery that would preserve the concept of seedbed preparation and seed application found successful with the Rotaseeder, but that would overcome its main drawbacks. It was also learned that the patent for the Rotaseeder had been sold to a company in France and it would be difficult and expensive to import additional machines.

A trip to the Farm Progress Show at Galesburg in September 1972 revealed that the Howard Company had recently begun to manufacture a new machine called a "Turf Quaker." The machine is designed for aerification of golf courses by cutting slits that allow air to get down to the grass root zone. With modification of cutting blades, it will do the same job of tillage as the Rotaseeder and probably will be more efficient, as the Turf Quaker is only 5 feet wide. Two of these machines have been purchased and will be fitted with new cutting blades for the seeding operations later this summer. Brillion seeders that seed and roll

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will be pulled behind the Turf Quakers. Thus, the same type of seeding operation successfully used on the FCMU will be used on W-85-D seedings--the order of operations will be somewhat different.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Squirrels have often been observed gnawing bark on such trees as sugar maple (*Acer saccharum*), red maple (*A. rubrum*), elm (*Ulmus* spp.), beech (*Fagus grandifolia*), and basswood (*Tilia americana*) during winter and early spring after a year of low mast production. However, the eating of pith from the center of twigs by squirrels has never been reported. On 23 November 1974 in the University of Illinois' Trelease Woods near Urbana, a female fox squirrel was seen clipping the end segments of Ohio buckeye (*Aesculus glabra*) stems, splitting these stems in half, and consuming the relatively large amount of pith from the center of these twigs. During a subsequent trip to Trelease Woods on 29 November, freshly split twigs were found under 10 different buckeye trees and a male fox squirrel was observed eating buckeye pith. Examination of the leaf litter revealed that squirrels had also eaten buckeye pith in Trelease Woods in previous years. Trips during December and March revealed a continued light consumption of buckeye pith throughout the winter.

In Brownfield Woods, approximately 2 miles from Trelease Woods, freshly cut buckeye twigs were found under one tree. This feeding habit was not observed on buckeye trees in any other of our study areas throughout the state this past winter, nor in any other tree species in Trelease Woods.

Samples of buckeye pith and pith from other abundant Trelease tree species (red oak, basswood, white ash (*Fraxinus americana*), and sugar maple) were analyzed to find why squirrels were eating only buckeye pith. Results showed that buckeye pith is almost as high in sugar content as sugar maple (11.6 percent versus 12.4 percent, respectively), whereas pith from the other tree species consisted of less than 4.0 percent total sugars. There was also a significant difference in the composition of the sugars in buckeye and the pith from the other species. For instance, sugar maple pith was 55.3 percent sucrose, a 12-carbon sugar, whereas buckeye pith was 65.9 percent raffinose, an 18-carbon sugar. Raffinose is a very sweet tasting sugar, and it consisted of less than 6.0 percent of the sugar content in the pith of the other tree species. Because of local food conditions, Trelease squirrels may have been eating buckeye pith as an early winter energy source since it is high in sugar content. However, they may have been eating buckeye pith because of its sweet taste.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

Food items found in the crops of quail harvested on the Dale and Forbes areas during the 1973-74 hunting season were identified, and the volumes of all seeds except acorn fragments (*Quercus* spp.) were determined. Seeds of 31 species of plants were found in 174 crops obtained from the Dale Area. The 10 most important species listed in order of decreasing volume of seeds consumed were: sunflower

(Helianthus spp.), soybean (Glycine max), wheat (Triticum aestivum), multiflora rose (Rosa multiflora), Korean lespedeza (Lespedeza stipulacea), corn (Zea mays), serecia lespedeza (Lespedeza cuneata), jewelweed (Impatiens pallida), and sassafras (Sassafras albidum), and tick clover (Desmodium spp.).

Sunflower was planted for the first time on Dale in 1973. It was readily accepted by quail. Sunflower seeds occur in 26 percent of the crops and comprised 35 percent of the total volume of seeds in the crops. The seeds of serecia lespedeza and multiflora rose were found in the crops of quail harvested during the January portion of the season when snow covered the ground.

Twenty-five species of seeds were identified in 179 crops from the Forbes Area. The 10 most important seeds listed in order of decreasing volume consumed were: Wheat, soybean, milo (Sorghum vulgare), corn, wild bean (Strophostyles spp.), Korean lespedeza, common ragweed (Ambrosia artemisiifolia), tick clover, ash (Fraxinus spp.), and giant foxtail (Setaria faberii).

Sunflowers were not available on the Forbes Area. On both areas seeds from cultivated crops comprised approximately 80 percent of the total volume of seeds found in the crops. Although the bobwhite consumes a wide variety of plant seeds during late fall and early winter, the bulk of the diet is supplied by seeds of agricultural crops.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Results of booming ground surveys conducted in seven counties of south-central Illinois in the spring of 1974 revealed a total of 208 prairie chicken cocks, a decline of 22 percent from the 266 cocks found in 1973. The 143 cocks in the Bogota flock comprised 69 percent of the known statewide total.

Prairie chickens were found on only five areas outlying the Bogota area. No prairie chickens were found near Fairman (4 cocks in 1973) or near Loogootee (2 cocks in 1973) this spring. However, three flocks increased--Bible Grove (4 cocks to 8 cocks), Mt. Erie (6 cocks to 9 cocks), and Hoyleton (3 cocks to 10 cocks). On the sanctuary areas in Marion County, the Kinmundy-Forbes Park flock declined from 22 cocks in 1973 to 13 cocks in 1974, but the Farina flock increased slightly from 22 cocks to 25 cocks. The flocks now associated with sanctuaries in Marion County (38 cocks) and Jasper County (143 cocks) constitute 87 percent of the known statewide population of prairie chickens.

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois June, 1974 Vol. 17, No. 6

Manipulation of Pheasant Habitat

G. B. Joselyn

The report for July 1973 (MWRL 16(7):1) pointed out that in the intensively farmed cash grain region constituting the prime pheasant range in Illinois, the timing and progress of annual farming activities can have a substantial impact on pheasant chick production in a given year. Data from studies at Sibley show that as much as 80 percent of all successful pheasant nests are produced in hay and on roadsides. Thus, any changes in normal farming activities that delay hay harvest or roadside mowing can benefit incubating hens by allowing them sufficient time to complete the hatch.

In 1973, wet weather delayed planting and cultivation of corn and soybeans throughout much of the Illinois pheasant range, which, in turn, delayed the harvest of hay and the mowing of roadsides, thus allowing a greater than normal proportion of nest cover to remain standing relatively late in the nesting season. These conditions were considered to have contributed substantially to good productivity of pheasants in 1973.

This past spring, indications were that hayfield and roadside cover would, unlike 1973, be mowed considerably ahead of normal. A dry fall in 1973 allowed virtually all fall plowing to be completed as planned, and dry weather in early spring expedited corn planting during the first 10 days of May. Thus, it appeared that roadside mowing was started earlier than normal by some farmers and that a greater than usual amount of hay was harvested prior to June 1.

However, frequent and sometimes heavy precipitation occurred throughout much of the Illinois pheasant range during the first 3 weeks of June. With the resulting long delays in planting and corn cultivation, no hay has been harvested (of what little there is) on either the study area at Sibley or on the Ford County Management Unit since June 1. There has also been a noticeable reduction in roadside mowing at Sibley and on the remainder of southern Ford County. Again, as in 1973, it appears that aberrant rainfall is helping pheasant productivity by delaying hay harvest and roadside mowing.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Monitoring the reproductive status of squirrel populations in late winter and early spring often indicates the successfulness of the approaching squirrel season. Squirrels born in February and March, from the first or winter breeding season,

are available to hunters at the beginning of the season in August and September. However, squirrels born in July and August, from the second or summer breeding season, do not become self-dependent and available to hunters until October, when hunter interest is waning.

The reproductive condition of squirrels in east-central Illinois this past spring was unusual. Two study areas in Vermilion County were livetrapped for 10 days in May for the fourth consecutive spring. The number of adult female fox and gray squirrels that had litters this spring was noticeably less than in previous years. Also, no juvenile squirrels were trapped. Twenty-four adult female squirrels were caught in May 1974, and only eight or 33 percent had spring litters. In comparison, 75 percent, 84 percent, and 69 percent of the adult female squirrels trapped on these two areas had spring litters in 1971, 1972, and 1973, respectively.

Reasons usually offered for poor spring reproduction in squirrels are mast failure and severe winter conditions, which adversely affect the physical condition of squirrels, and high population densities and resulting social stress. Other researchers have noted a reduction in squirrel reproduction in the winter breeding season after a fall mast shortage. One of the major staple mast crops for squirrels in Illinois is white oak acorns. There were virtually no white oak acorns available last fall in many areas of the state, including Vermilion County, because of a late freeze in May 1973 that killed the young fruit. Also, the severe cold, the large amount of snow, and the long duration of snow cover in December and January of this past winter in east-central Illinois may have adversely affected the squirrels' physical condition and, therefore, reproduction.

Trapping of squirrels in southern Illinois, on the Old Barn Sale Area in Pope County, this past March yielded different results for the winter breeding season (MWRL 17(4):2). A total of eight adult female squirrels were trapped and all had spring litters. However, the Old Barn Sale Area consists mainly of large red oaks, which take 2 years for their mast crops to ripen. Therefore, the freeze in May of 1973 would affect the red oak crop in 1974 and not in 1973--as with white oaks. Apparently, an ample supply of red oak mast was available to the squirrels inhabiting the Old Barn Sale Area. The winter in southern Illinois was also less severe than in east-central Illinois and thus allowed squirrels to reach the winter breeding season in better physical condition.

Squirrel reproductive success varies among localities not only because of differences in population densities but also because of differences in climate and habitat and their interactions, which affect the physical condition of squirrels.

Responses of Bobwhites to Habitat Manipulation

J. A. Ellis

In 1966 a study was initiated on a 250-acre portion of the Dale Area to determine the responses of vegetation and bobwhites to prescribed burning. The 250-acre zone was divided into 21 plots comprising 125 acres. From 1966 to 1970, half the plots were burned each year. In 1970 and in 1971, all 21 plots were burned. In 1972, 16 plots were burned and the prescribed burning program was

terminated. All burning was conducted in February or March. Quadrat samples of the vegetation occurring in burned and unburned plots were taken each year in late July or early August, and importance values were calculated. Professor Samuel Carmer, Department of Agronomy, University of Illinois, performed statistical analyses of the data. In these analyses, only the 10 most common plants in the plots were used. These plants were tickle grass (Agrostis hiemalis), common ragweed (Ambrosia artemisiifolia), broom sedge (Andropogon virginicus), stick-tights (Bidens spp.), partridge pea (Cassia fasciculata), rough buttonweed (Diodia teres), serecia (Lespedeza cuneata), Korean lespedeza (Lespedeza stipulacea and L. striata), panic grass (Panicum huachucae), and goldenrod (Solidago spp.).

Statistical analyses revealed at least three sources of variation in the importance values of the 10 species examined. (1) The importance values of 9 of the 10 species varied significantly among plots. Thus, plant communities varied significantly among plots. (2) For 8 of the 10 species, importance values varied significantly among years. Thus, conditions for particular years had significant effects on the plant communities. (3) The importance values of 3 of the 10 species were significantly affected by prescribed burning. Common ragweed and partridge pea were significantly enhanced by burning whereas panic grass was significantly reduced. In addition, the "F" ratios of broom sedge, serecia, and Korean lespedeza approached significant levels. Thus, the plant community was significantly modified by prescribed burning.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

During the spring of 1974, 416 people visited the prairie chicken booming grounds in Jasper County on a reservation basis. Beginning with 56 people in 1966, when records were first kept, the number of visitors has gradually increased each spring and has totaled 2,277 to date. Duplications probably amount to about 10 percent. This spring, 47 groups representing 27 different universities, colleges, high schools, Audubon clubs, or other organizations and agencies were involved on 32 mornings (limit of about 20 per morning) this spring. In addition to Illinois, groups came from six states (Missouri, Indiana, Kentucky, Ohio, Pennsylvania, and Massachusetts) this spring.

Visitors aided the research project by recording their observations on standard forms during 66 blind mornings (one or more observer per blind per morning). Although college students continue to provide the best observations, each blind morning provided some usable information. Information recorded included the number of cocks and hens present; the number of copulations observed; and the effects of interactions, both intraspecific and interspecific, on booming ground behavior. These data give us detailed information on the stability of booming grounds in terms of their locations and the numbers of birds using the various grounds. Observer records also provide a basis for determining the peak period of hen visitation and copulations on the display grounds. The period between about March 30 through about April 12 has always been the peak period of courtship and matings. Although the peak count of 143 cocks at Bogota in 1974 was 29.6 percent

lower than in 1973, the peak count of 96 hens in 1974 was the same as in 1973. Fifty-two copulations were observed in 1974; 59 were observed in 1973.

Notes on booming ground behavior have shown the existence of a dominance hierarchy among hens as well as among cocks. Vigorous disputes often occur within a group of hens on a booming ground and presumably the more dominant hens are mated first. Marsh hawks are generally the most common source of disruption on a booming ground, although interactions between the prairie chickens and short-eared owls, red-tailed hawks, pheasants, coyotes, dogs, and farming activites are also commonly noted.

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Mrs. Dodds

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | July, 1974 | Vol. 17, No. 7

Manipulation of Pheasant Habitat

G. B. Joselyn

Since the primary purpose of roadsides is for drainage, the question is sometimes asked whether significant numbers of pheasant nests established on roadsides are destroyed by water deep enough to cover nests. Data on 486 nests located on seeded roadsides on the Sibley study area over the 10 years 1963-72 indicated that less than one-half of 1 percent of these roadside nests were destroyed by water.

Nest studies conducted during 1973 and under way this year on the Ford County Management Unit show somewhat higher rates of nest destruction from flooding. Rainfall during the past two springs, in May and June, has been substantially above normal on the management unit. Several downpours during these months in both years resulted in flooded fields and deep water standing on some roadsides. In 1973, 5 of 196 pheasant nests located on management unit roadsides (3 percent) were flooded; so far this year 3 of 99 nests located on these roadsides (3 percent) were flooded. Pheasant eggs that have stood under water are usually covered with mud, so it is probable that additional nests were flooded but were not located during the searches. Since precipitation during the past two springs has been considerably above normal, the 3 percent rate of nest destruction may be somewhat lower during years of normal rainfall. Pheasants seldom nest in ditch bottoms; rather, the vast majority of nests occur on the higher backslope and foreslope areas, where there is the least chance of flooding except during times of extremely high water.

Nest studies on the Ford County Management Unit this year suggest that considerable numbers of pheasant nests established in waterways have been destroyed by flooding. On the first search of a sample of study-area strip cover (fencerows, waterways, drainage ditches, travel lanes), a total of 13 nests were located, 7 of them in waterways. Four of the waterway nests--31 percent of all strip cover nests and 57 percent of waterway nests--were destroyed by flooding.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Midwinter census data for Illinois fox and gray squirrels are available. Visual counts were taken at five sites in 30 counties from 1958 to 1962 and in 35 counties from 1963 until the present by William L. Preno, Illinois Department of Conservation. The time-area method was used to census the squirrels. The count was taken during a 20-minute period between midmorning and midafternoon on sunny calm days. Each year, squirrel counts were taken from a vehicle positioned in the same place at each site.

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These census data were incorporated into seven weather regions for an eventual squirrel-weather analysis. The weather regions formulated consist of the counties in the average April and May isotherms for Illinois. Minimum daily temperatures in April and May are of primary importance to oaks and hickories, which flower during these months. Fruits developing on these hardwood species during April and May are staples for several forest game species.

Within the weather regions, linear correlation analyses revealed that census counts of 1 year were not similarly or significantly correlated with the census counts of the succeeding year. Linear correlations of the census data and the harvest indices of the number of squirrels killed per hunter trip in the fall preceding the census counts or in the fall subsequent to the censuses were also performed. The census data and the harvest data were negatively and not significantly correlated in all but one region. The census data do not appear to give a good indication of the next year's census count nor of the harvest trend for the number of squirrels killed per hunter trip.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier, D. R. Vance

In contrast to the 10-year period of 1963 through 1972, when success of the hatch of prairie chicken nests on sanctuaries at Bogota averaged 66.9 percent, and not lower than 57.1 percent, nest success dropped to 31.1 percent in 1973. The poor hatch last spring was followed by a 29.6 percent decline in the breeding population in the spring of 1974.

As of 18 July 1974, 48 nests have been located on the sanctuaries at Bogota, only 15 of which (31.3 percent) were hatches. Thirty-one of the unsuccessful nests were destroyed by predators and one was judged to have been abandoned. Thus, the heavy rate of predation on nests is continuing for the second consecutive year. Opossums, raccoons, skunks, and increasingly, coyotes, are probably the main predators involved in the nest destruction.

Prairie chicken nests appear more vulnerable to predators during unusually wet weather, considering that the seasons for nesting in both 1973 and 1974 were characterized by rainfall that was well above normal. Also, the food base of predators continues to be low in quantity on prairie chicken sanctuaries, as the nests of other ground-nesting birds and the nests and sightings of cottontails and small mammals appear sharply reduced compared to the period of 1963-72.

Other studies have suggested that high populations of buffer species result in increased numbers of predator hours in a given field and therefore that the "finds" by predators of food items such as prairie chicken nests, which remain stationary for about 40 days or more, must increase in direct proportion. Our data, however, do not support this contention. It seems to us that the low quantity of buffer species, combined with excessive rainfall, has resulted in the more intensive exploitation of the prairie chicken resource by predators.

Editors' Note

The Quail Project was terminated by the Department of Conservation effective 30 June 1974. Mr. Jack A. Ellis, an employee on various research projects funded by the Department of Conservation at the Natural History Survey for the past 20 years, was employed by the Department of Conservation as leader of the Department's statewide inventories project.

We are sorry to lose Jack's abilities as a research biologist with the cooperative research program and wish him well in his new position.

cat,

Mrs Dodds

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois | August, 1974 | Vol. 17, No. 8

Manipulation of Pheasant Habitat

G. B. Joselyn

When studies were initiated in 1962 to determine the potential of managing roadside cover for nesting pheasants, the practical aspects of seeding roadsides, other than providing attractive and productive pheasant nest cover, had to be considered. Among these aspects were (1) the appearance of the seedings to farmers and to the motoring public, (2) their properties of weed control, (3) and their effects on drainage.

With few exceptions, the 8 miles of seedings established during the period 1962-64 on the Sibley study area and the 73 miles of seedings established on the Ford County Management Unit (FCMU) in 1968 have presented an acceptable appearance to farmers and have generally controlled (or at least hidden) weeds. During the 12 years (1963-74) of dealing with approximately 30 farmers on the Sibley study area who have seeded roadsides adjacent to their properties, no complaints have been voiced about the unmowed roadside seedings retarding field runoff. Also, until the extremely wet springs of 1973 and 1974, there were no complaints from the approximately 60 FCMU farmers.

The aberrant spring rains the past 2 years have apparently prompted concern on the part of at least some FCMU farmers about the effects that unmowed seeded roadsides are having on field runoff. Four farmers have made unsolicited comments on this subject to project personnel during the past summer, and at least two farmers mowed parts of all of their roadsides in what they considered were attempts to improve drainage. There was, however, no widespread mowing of seeded roadsides on the FCMU the past two springs, which perhaps indicates that most cooperators do not consider that drainage on seeded roadsides is a serious problem on their farms. Nevertheless, the known concern of some farmers no doubt implies that others may have similar feelings. It is believed that such feelings are due primarily to the unusually heavy rains during the past two springs and do not reflect a widespread problem on the management area during normal springs.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

County harvest data for Illinois fox and gray squirrels were compiled for seven weather regions as described in MWRL 17(7):2. The harvest statistics were obtained by William L. Preno, Illinois Department of Conservation, from questionnaires sent to a random sample of resident hunters in Illinois.

NATURAL HISTORY SURVEY

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Examination of the linear correlation analysis of the number of squirrels killed per hunter trip from 1958 to 1972 with the number killed per trip the subsequent year indicated no significant or consistent correlation. Likewise, the total kill of squirrels within the seven weather regions from 1956 to 1972 was not significantly or consistently related to the total kill the subsequent year.

Like the squirrel census data (MWRL 17(7):1-2), the harvest data for Illinois squirrels appears to have little year-to-year consistency. The basic reason may be the reliance on hunter-kill reports for compiling harvest data. It may be more difficult to acquire reliable information from squirrel hunters than from hunters of other game species because (1) squirrel hunters kill large numbers of squirrels each year and tend to forget how many, where, and when kills were made, and (2) their memories may be less exact because squirrel seasons open much earlier than other seasons and as many as 5.5 months can elapse between an early August squirrel kill and the mid-January game questionnaire.

<u>Responses of Prairie Chickens to Habitat Manipulation</u> R. L. Westemeier, D. R. Vance

Grassland management on nest sanctuaries for prairie chickens is accomplished primarily by harvesting the seed from redtop and timothy grasses--long the substitute prairie in south-central Illinois. The customary sharing basis of 50:50 between landowner and tenant has significantly minimized management costs, as grassland not combined for seed must generally be rotary mowed at a cost of about $2.50 to $3.00 per acre. Clipping by either combining or rotary mowing aids in weed and brush control, although the first method produces a more desirable stubble cover for nesting, brooding, and roosting prairie chickens. Custom combining of a crop such as redtop has now reached $12.00 per acre, and on state-owned sanctuaries farmers are assessed for taxes amounting to $5.00 or $6.00 per acre. These costs, plus those for handling and hauling of seed, must be considered in leasing agreements. The market price of redtop seed and the quality of individual fields of redtop are the main determiners of how much redtop acreage farmers are willing to harvest. The economic aspect was particularly good in 1973, as the market price reached $0.75 per lb in contrast to $0.52 per lb in 1972 and about $0.35 to $0.30 in previous years of this project. Per acre incomes exceeding $100.00 were common in 1973. One farmer reported an income of over $1,400.00 from only 4.5 acres of redtop on his farm.

The high market price in 1973 apparently resulted in an increased acreage and yield (through fertilizing) of redtop on private farmland in 1974; this factor, combined with a large carry-over of seed from 1973 caused the price to drop from $0.60 per lb on 26 July to $0.30 per lb by 16 August in 1974. It was evident this year that perhaps every cow pasture and dewberry patch containing redtop was harvested for the seed in anticipation of a high market value. Thus, it is likely that the market price of redtop may drop further to perhaps $0.25 per lb or less in 1975. These economics pose difficulties for contemporary prairie chicken

management in Illinois, particularly on state-owned sanctuaries. On sanctuaries owned or leased by The Nature Conservancy (894 acres), farmers can be granted a larger-than-customary share of the crop of grass seed, but on state-owned sanctuaries (567 acres), the taxes and the costs of combining and hauling may exceed the income from an average stand of redtop. An average yield of 100 lb of redtop per acre would amount to $25.00 per acre at a price of $0.25 per lb. Thus, only the stands of highest quality will likely be harvested. The new cash-bidding procedure to be implemented on state-owned sanctuaries in 1975 may have to include a substantial share of a sizable acreage of soybeans in order to accomplish the desired amount of grassland management through seed harvesting.

Mrs. Dodds

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

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Manipulation of Pheasant Habitat

G. B. Joselyn

There are indications of a rather substantial decline in pheasant population levels on the Sibley study area (SSA) and on the Ford County Management Unit (FCMU), compared with 1973. Based on tentative calculations, the decline appears to be in the range of 40 to 50 percent.

Aberrant weather conditions last spring (wet) and during July (dry) make an accurate assessment difficult, but the data seem to show the following:

1. Breeding populations on both areas this past spring were about 20 percent below those of 1973.

2. August brood counts on both areas showed rather sharp declines in total numbers of broods observed, and, particularly on the SSA, an unusually low proportion of hens with broods (34 percent).

3. Tentative calculations from simultaneous nest studies carried out last summer on the FCMU and SSA show that productivity on the FCMU declined over 40 percent from 1973 (510 to 297 successful nests); no comparative data were available from the SSA for 1973 but a similar decline in productivity is suspected for that area.

On the SSA, the decline in numbers of broods observed during early-morning counts in August approached 70 percent (29 broods per 100 miles in 1973, 9 broods per 100 miles in 1974); on the FCMU, the decline was 43 percent (56 broods per 100 miles in 1973; 32 per 100 miles in 1974). The proportion of hens observed with broods on the SSA in August (34 percent) was the lowest of the past 13 years (1962-73 average was 74 percent); the corresponding figure on the FCMU, 69 percent, was near the 8-year average. The decline can be attributed in part to conditions that made observations difficult, as half the mornings in August on which brood counts were made had little or no dew, an extremely unusual circumstance for that time of summer.

Hence, we conclude at this time that the decline in pheasant numbers in late summer, 1973 to 1974, on the two areas is 40 to 50 percent and that the dissimilar figures shown by the nest studies and brood counts can be largely explained by the unusually poor conditions for observation of broods in August.

Bill Preno and Jack Ellis calculate 40 to 50 percent fewer young per square mile throughout the prime pheasant range this year compared with late summer 1973.

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Biologists in Indiana report a similar decline for their prime west-central range, and Iowa reports a comparable decline for the east and central parts of that state. All of these areas, like east-central Illinois, had unusually wet conditions (including flooding) in May and June and an extremely dry July last summer.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Several researchers have shown a relationship between mast production and population levels of squirrels and other forest game species. One critical period occurs during April and May, when oak and hickory trees flower and set fruit. A freeze at this time may reduce mast production to below normal.

To determine the relationship between spring temperatures in Illinois and squirrel indices, weather and squirrel parameters were presented for seven regions, based on April and May isotherms (MWRL 17:7). Weather stations that gave good areal representations of each region were selected. Squirrel harvest, census statistics, and weather data for various counties were recorded on a regional basis for the analyses.

Linear correlation analyses were performed with the numbers of days below 32 F and the lowest minimum daily temperatures for the periods April 1-15, April 16-30, May 1-15, and May 16-31 from 1956 to 1973 against (1) the squirrel census data for the subsequent January and February, (2) census data 1 year after the subsequent January-February censuses, (3) squirrel harvest indices of the total kill and kill per hunter trip in the subsequent fall hunting seasons, and (4) the harvest indices 1 year after the subsequent fall hunting seasons.

Results of the correlation analysis failed to yield any consistent and significant results. The only apparent trends in all of the regions were the negative relationships of the numbers of days less than 32 F during April 16-30 and May 16-31 and the positive correlation of the lowest minimum daily temperatures from April 1 to 15 with the squirrel censuses in the subsequent January and February for the years 1958-73. Although these trends were not significant in all regions, the frequency of freezing temperatures in the last part of April, when tree leaves and flowers begin to appear, and during the last part of May, when fruits have set, may be detrimental to squirrel populations. Warm minimum daily temperatures during the first part of April were favorably related to squirrel censuses, perhaps because warm temperatures at this time may favor an earlier flowering and fruiting of the mast-producing species.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

In a preliminary assessment of the nesting season of 1974 (MWRL 17(7):2), we predicted that nest success on the sanctuaries at Bogota would be as poor as in 1973. Of the total of 64 nests found this summer, the fate of 3 was unknown and

2 were atypical (single eggs in a definite bowl). Of the remaining 59 nests of known fate, 40.7 percent were successful and 57.6 percent were destroyed by predators. Nest success in 1973 was 31.1 percent, the lowest recorded in the 11 years of this study; nest success for the preceding 10 years (1963-72) averaged 66.6 percent and no year was lower than 50 percent.

Although hatch success in 1974 was improved over 1973, the number of fertile eggs per clutch (9.6), the number of hatched eggs per clutch (8.9), and hatchability (82.3 percent) were all below similar statistics for both 1973 and the long-term means for 1963-74. Because of the low hatchability of eggs, fewer chicks left 24 hatched nests found in 1974 than left 23 hatches found in 1973.

In 1974, hen kills occurred at 10.3 percent (4) of the nests that were unsuccessful due to predation or abandonment. Over the 12-year period, 1963-74, nest sites showing evidence of hen kills averaged 12.1 percent of 199 nests that were destroyed by predators or abandoned.

Probably the most practical management implication to be emphasized by the past 2 years of poor nest success is the problem of minimizing predator habitat. Denning sites in particular should be eliminated wherever possible on the prairie chicken sanctuaries. We hope that the high rate of predation to which nests have been subjected the past 2 years is a temporary phenomenon due largely to the exceedingly wet nesting seasons.

Mrs. Dodds

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois — October, 1974 — Vol. 17, No. 10

Manipulation of Pheasant Habitat

G. B. Joselyn

At this time, slightly less than 3 weeks before the opening of the pheasant season on 9 November, it appears that considerable corn will be unpicked throughout a large part of east-central Illinois on opening day. The soybean harvest is nearly complete in Ford and surrounding counties, but the corn harvest is just getting under way. Probably only 10-15 percent of the corn has been harvested. Some farmers appear to be waiting to take advantage of good drying weather to reduce moisture content before beginning the harvest.

On the Sibley study area over the years, hunter success on the opening weekend of the pheasant season has been more or less inversely proportional to the acreage of crops still standing. Thus, with considerable corn still in the fields and pheasant numbers substantially reduced from 1973, hunter success this year may be below average on the opening weekend of the season.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

A zoning system to control hunting seasons in Illinois has been used to differentiate squirrel hunting seasons between northern and southern Illinois for the past 50 years. The Illinois legislature set up the first zoning system in 1923, believing that uniform statewide hunting regulations could not provide adequate protection for game animals in a state as large as Illinois.

Three zones were used between 1923 and 1954; since 1955, only two zones have been used, but the zone line was moved northward in 1965 to State Route 36.

An examination of the hunting season in each zone since 1923 provides these general conclusions: (1) the squirrel season for northern Illinois has usually opened on or about 1 September with the exception of 1939-40, when the squirrel season opened 1 August; (2) the squirrel season has never opened later than 1 August in southern Illinois, and for nearly half of the 50-year period (22 years) the squirrel season opened in July; and (3) season closing dates in all zones were relatively early, frequently in October, with most squirrel seasons adjusted to last between 2 and 3 months in each zone.

We have been evaluating the present Illinois squirrel season in terms of hunter satisfaction, hunter interest, and effect on the statewide squirrel population. We have concluded that the framework of the present season is a

suitable compromise between conflicting viewpoints. As regards the zoning concept, we found that (1) according to a demonstrated high number of hunter trips taken by hunters in the south zone in August, the delayed opening of the squirrel season does reduce the total season hunting pressure in northern Illinois. Hunter interest in the state is highest from mid-August until mid-October. Thus, the present seasons give the southern hunter 8-9 weeks and the northern hunter 6 weeks of prime hunting time. And (2) the small scattered tracts of forest available to the northern hunter are potentially vulnerable to overshooting. The 1 August opening in the south zone places the most sustained hunting pressure in the more extensive forests of southern Illinois, where squirrel populations are least likely to be overshot.

However, we do believe that the Department should consider changing a portion of the zone line in order to include a few more counties in the southern zone. We believe that hunters in the west-central Illinois counties could enjoy an additional month of squirrel hunting without damage to the squirrel population. We propose that west of Springfield in Sangamon County, the zone line be shifted northward, using State Routes 97 and 136 as new zone boundaries. This zone change would put all or parts of the following counties in the south zone: Adams, Cass, Brown, Schuyler, the northern portions of Scott, Pike, and Morgan counties, the western portions of Mason, Menard, and Sangamon counties, and the southern portions of Fulton, Hancock, and McDonough counties. Several of these counties contain more forest land (squirrel habitat) than many of the counties now included in the south zone. Schuyler (21.1 percent forested), Fulton (15.8 percent forested), Cass (13.5 percent forested), and Brown (19.4 percent forested) counties all contain more forest land than Shelby (12.5 percent forested), Coles (6.3 percent forested), and Douglas (1.7 percent forested) counties, which are now in the southern hunting zone.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

The demise of prairie chickens on private farmland in Illinois has been a direct result of the increasing intensity of cash-grain farming. The differences between today's agriculture and that of 35 years ago are startling. Fortunately, the early work of the late Dr. Ralph E. Yeatter and Charles S. Spooner, Jr., allows us to compare the farm practices and prairie chicken populations of 1939 with those of 1974.

Yeatter's booming ground census of the 2,760-acre Hunt study area in Jasper County (10 miles northeast of the Bogota area) revealed 131 cocks in the spring of 1939. Continued censuses on the area documented the gradual disappearance of prairie chickens. No prairie chickens have been seen here since the observation of a single pair in 1968.

Spooner cover-mapped the Hunt area in 1939, providing us with valuable information on the habitat that produced that year's peak population of

prairie chickens. The area was cover-mapped again this year. In 1939, grassy cover (including pastures and redtop and timothy harvested for seed or hay) constituted 47.1 percent of the area. In 1974, only 1.0 percent of the area remained in grass, and this remnant was primarily overgrazed pasture. Soybeans, used mainly for hay, covered only 9.4 percent of the area in 1939. In 1974, soybeans were planted on 68.8 percent of the land. As cash-grain farming expanded, average field size more than doubled (from 10 acres to 23 acres) at the expense of fencerows. In 1939, the 2,760-acre Hunt area contained about 43 linear miles of woody fencerows. Now the area contains less than 6 miles of good fencerow cover.

These changes in farm practices have eliminated most of the grassy cover essential for prairie chickens, tremendously reduced both the quantity and quality of edge, and decreased habitat diversity. Continuation of these agricultural trends can be as disastrous for other game and nongame species as they were for prairie chickens.

ncat.

Mis Dodds

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

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Pheasant Populations and Land Use

G. B. Joselyn

Hunting pressure on the Sibley study area during the opening weekend of the season in 1974 was quite light. Conditions for hunting on the opening day were good, as fields were dry, approximately 80 percent of the corn had been harvested, and fall plowing was not far advanced, approaching perhaps 25-30 percent of the soybean and corn stubble acreage. Steady rains all during Sunday, the second day of the season, greatly reduced the hunting effort.

Hunter success on the opening weekend this year was the poorest in the past 13 years. The 115 hunters that were interviewed on the study area on the opening weekend hunted 430.5 man-hours and killed 52 pheasants (8.3 hours per bird). In only 2 other years since 1962 has bagging a pheasant on the study area taken 8 hours or longer (8.0 hours in 1965, 8.1 hours in 1967). The number of hours in the field to kill a pheasant, 1962 through 1973, were, respectively: 2.2, 2.7, 2.1, 8.0, 6.9, 8.1, 5.0, 4.3, 4.7, 3.4, 6.2, and 7.4 hours.

The lengthy time required to bag a bird this year (and in 1965) was mostly the result of low pheasant numbers on the study area (MWRL 17(9):1-2). Although pheasants were relatively abundant in 1967, standing corn and soybeans and wet field conditions combined to decrease hunter success.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

A comparison between the estimated statewide squirrel harvest and the available forest land in Illinois strongly suggests that the present harvest estimate is much too high. We do not believe that Illinois squirrel hunters are killing nearly one squirrel per 1.5 acres of forest every year--not a single state approaches such a squirrel harvest. In fact, 206,000 Missouri squirrel hunters hunt some 15 million acres of forest and kill about the same number of squirrels (2.7 million) as the estimated kill in Illinois, which has only 3.8 million acres of squirrel range. Thus, the Illinois kill, on the basis of an acre of range, is nearly five times that of Missouri. It is doubtful that the Illinois squirrel hunter is that much more proficient than his Missouri counterpart.

Attempts to improve our knowledge of the Illinois squirrel resource must begin by improving the accuracy of mail-survey estimates of the squirrel harvest.

Beyond the initial problem of developing a random sample of hunters, there are two sources of bias in mail surveys: (1) response bias--hunters who incorrectly report their take and trips, and (2) nonresponse bias--differences in hunting activity between those who respond and those who do not respond. A serious effort has not yet been made to define the extent of either type of bias in estimates of the squirrel harvest. The present estimate may be inflated as much as 500,000 squirrels or more.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

As of 1 November 1974, 17 acquisitions totaling 1,460 acres (1,000 in Jasper County, 460 in Marion County) are being managed for prairie chickens by the Natural History Survey. Additional land to complete the goal of 1,500 acres in each county is not presently available for purchase--at least not in suitable locations for prairie chickens--except for one tract of 100 acres in Marion County. The asking price for the 100-acre tract is $800 per acre. The Prairie Grouse Committee of The Nature Conservancy is now negotiating with the owner, in accordance with our recommendation to purchase this property. Although $800 per acre may seem high, a few tracts of farmland comparable to much of the present sanctuary land (purchased for $225 and $525 per acre) have recently sold for over $1,100 per acre in nearby communities. Thus, it has become increasingly difficult to add to the sanctuary systems and perhaps impossible to achieve the goal of 1,500 acres in each county if we are limited to acquiring land by purchase.

Additional land for prairie chicken management may become restricted to such areas as that to be used for the electrical power generating complex now under construction in Jasper County by Central Illinois Public Service Company (CIPS). Because of the sizable acreage of prairie farmland involved and the close proximity to the Bogota flock, this area appears to have considerable potential for prairie chicken management--provided a cooperative program can be agreed on and implemented. The four units on the CIPS area that are potentially suitable for prairie chickens total about 1,000 acres and thus could double the present sanctuary acreage of 1,000 in Jasper County. CIPS officials were presented with a preliminary proposal for prairie chicken management in July 1974 and have taken our proposal under advisement.

Uncat.

Dodds

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

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Manipulation of Pheasant Habitat

G. B. Joselyn

Data collected from 1963 through 1972 on selected roadsides on the Sibley study area (SSA) that were seeded to an alfalfa-bromegrass mixture showed that such cover, when left unmowed, constitutes highly desirable and productive cover for nesting pheasants. In a pilot management program undertaken by the Department of Conservation in 1968, over 90 percent of the roadsides in and abutting the 16-square-mile Ford County Management Unit (FCMU) were seeded or treated with nitrogen, or both, to enhance pheasant nest cover.

One of the goals of this pilot program was to study the possible effects of such an extensive roadside seeding on pheasant numbers in the area. Numbers of cock pheasants observed per mile of road driven in spring, calculated numbers of cocks and hens per square mile in spring, and calculated numbers of juveniles per square mile in August had all showed nearly the same or fewer pheasants on the FCMU than on the SSA or in Game Region 4, the prime pheasant range of Illinois, for the 4 years prior to maturity of the seedings. For the first 4 years after maturity of the seedings, all indices for the FCMU indicated 1.5 to 2.5 times more pheasants than either the counts at Sibley or those for Game Region 4.

To conclude that the increase in pheasants on the FCMU was a direct result of the seedings, although tempting, was considered somewhat premature. Consequently, nest studies on the FCMU were carried out in 1973 and 1974 and on the SSA in 1974 in an attempt to clarify population data and to demonstrate the contribution of roadsides on the two areas (seeded on the FCMU; unseeded on the SSA) to total pheasant production.

Data in Table 1 show that seeded roadsides on the FCMU contributed substantially to total production on the area during both years (10 of 26 successful nests per section, 38 percent of the total in 1973; and 9 of 15 successful nests per section, 60 percent in 1974). Comparison of data derived from both areas shows that the difference in average successful nest production per section between the two areas in 1974 (SSA, 7+ nests per section; FCMU, 15+ nests per section) was almost entirely attributable to production from seeded roadsides. Thus, average successful nest production from cover types other than managed roadside cover was nearly the same on both areas in 1974 (SSA, 5+ nests per section; FCMU, 6+ nests per section), whereas the seeded roadsides on the FCMU produced 4.5 times more nests per section (9) than did the unseeded roadsides on the SSA (2).

NATURAL HISTORY SURVEY

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These data indicate that differences in pheasant population levels between the two areas are probably largely the result of higher productivity from roadsides on the FCMU.

Table 1. Estimated average number of successful pheasant nests per square mile, Sibley study area (SSA) and Ford County Management Unit (FCMU), 1973 and 1974.

	1973	1974	
	FCMU	SSA	FCMU
Hay	6	2	2
Pasture	2	0+	0+
Small grains	2	1	1
Strip/Nonagricultural	6	2	3
Roadsides	10	2	9
	26	7+	15+

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

In last month's report (MWRL 17(10):1-2), we pointed out the probable error in the estimated squirrel harvest for Illinois. There are two possible sources of error involved in the present mail survey--response and nonresponse.

We recognize that response bias will be more difficult to cope with than nonresponse bias. The 5.5-month (August-January) delay between the end of squirrel hunting and the receipt of questionnaires undoubtedly contributes to errors in reporting game kills. Two possibilities for reducing this bias are: (1) to compile a mailing list of potential squirrel hunters from individuals who purchased licenses the previous year, contact them before the season, tell them that they have been selected to help in estimating the kill of squirrels, and urge them to keep records; and (2) to mail a separate squirrel hunter questionnaire to these hunters in mid-to-late November. This procedure would reduce by about 2 months the time interval between the end of squirrel hunting and the arrival of questionnaires.

Nonresponse bias may best be overcome through repeated mailings. In Michigan, the Game Division has achieved a better than 90 percent rate of return using repeated mailings of up to five questionnaires for estimating harvests of small game. They send new questionnaires with each mailing, repeat

the mailings to nonrespondents at 2-week intervals, and code questionnaires so that responses to each mailing can be evaluated separately.

In summary, we urge a fresh approach by the Survey and inventory project, Department of Conservation, to estimating the squirrel harvest. As a first step, it is mandatory that a statistician familiar with mail questionnaires be consulted to discuss sampling techniques and to develop new mail-survey methods for future years. In the future, all data should be key-punched for computer analysis and storage. At least in some years, the names of all license buyers should be available for sampling. The present method selects only the first license buyer in each book of 25. Unfortunately, license stubs are not collected in central places (1,400 agents statewide) and are disposed of by each agent after the hunting season. However, the Division of Accounting is in the process of changing its reporting system, and it may be possible to receive all license stubs in Springfield, at least in an occasional year (H. Davis, Division of Accounting, Department of Conservation, Personal Communication 1974).

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

A desirable goal in habitat management for any species of wildlife is to accomplish a maximum of ecologically sound manipulations at minimum expense. Much of the management on prairie chicken sanctuaries has been accomplished through sharecropping leases with 11 local farmers or through contractual services. Project personnel do all the prescribed burning and selective brush spraying and some of the rotary mowing and seeding.

The income from habitat management, including crops, grass-legume seed, hay, pasture fees, and Federal farm programs amounted to $30,989.50 for the past 3 fiscal years (1971-72, 1972-73, and 1973-74) for the Prairie Grouse Committee of The Nature Conservancy (PGC), which now owns or leases 894 acres. Expenses to the PGC for habitat management during the same period, including fertilizer, seed, fuel, chemicals, equipment, and land taxes totaled $25,492.50, leaving a balance of $5,496.96.

The income to the Illinois State Treasurer from habitat management on 567 acres owned by the Illinois Department of Conservation (IDC) and dedicated as Illinois Nature Preserves amounted to $2,928.90 in FY 1973-74. Expenses to the IDC amounted to $2,030.02, thus leaving a balance of $898.88. Income to the State for FY 1974-75 will be about $3,500.00, whereas expenses to date have been $1,142.95. If field conditions permit, however, recently authorized applications of fertilizer and limestone on state-owned sanctuaries will substantially increase expenses. To date, however, the costs of habitat-management activities to both the PGC and the IDC have remained well below the income.

The new cash-bid procedure to be implemented on the state-owned sanctuaries will (initially at least) result in substantially reduced revenues to the State

Treasurer. The cash bids received in September 1974 for the 1975-76 crop years ranged from \$0.13 to \$11.00 per acre per year. These bids are likely to produce revenues amounting to about \$1,138.00, or about one-third of present revenues. However, the farmer with the lowest bid also agreed to furnish the State with 300 lbs of clean redtop seed (worth about \$300 00) in addition to his payment. All farmers will be assessed for land taxes on acres actually farmed, combined, hayed, or pastured. New seedings are also to be made at the bidders' expense. We hope that a larger share of habitat management can be accomplished by farmers through the new cash-bid approach than was feasible through the old cash-sharecrop system. Another advantage will be that we as sanctuary managers will not need to concern ourselves with elevator receipts and weight tickets to document the State's share of each crop. Successfully bidding farmers will be charged simply on the basis of their bids and the total acreages farmed.

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